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Maternal Nutritional Interventions in Preconception Care

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Abstract

The health care offered before conception in order to optimize the outcome of a given pregnancy is preconception care. Preconception counselling is a part of preventive medicine. It includes risk assessment and education every reproductively capable women create reproductive health plan. Optimizing women's health before and between pregnancies is an ongoing process that requires access to and the fall participation of all segments of the health care system. Maternal nutrition plays an important role for pregnancy outcomes and for the health of newborn. Providing simple nutritional interventions before pregnancy can reduce maternal and neonatal mortality and morbidity women of childbearing age should achieve and maintain good nutritional status prior to conception.

Keywords: Preconception Care; Interventions; Nutrition; Counselling.

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Introduction

The health care offered before conception in order to optimize the outcome of a given pregnancy is preconception care. It is the preventive care for women of reproductive age and their partners, including assessment by history and physical exam, counselling, education and intervention [1]. Preconception care proposes a process of delivering direct or indirect health care interventions that have a potential to identify or modify the biomedical, behavioural and social risk factors attached to pre-pregnancy, pregnancy, intrapartum, neonatal and childhood mortality and morbidity [2].

At the time of conception, maternal nutritional status is an important determinant of embryonic and fetal growth. Placental and fetal growth is most vulnerable to maternal nutrition status during the preimplantation period and the period of rapid placental development, which occurs during the first few weeks of development typically before pregnancy has been confirmed [3]. Most organs form 3-7 weeks after the last menstrual period and any teratogenic effects may occur by this time. Evidence is emerging that a mother's diet and lifestyle influence the long-term health of her children [4]. Inadequate levels of maternal nutrients during the crucial period of fetal development may lead to reprogramming within the fetal tissues that predisposes the infant to chronic illnesses in adulthood. Barkers Hypothesis states fetal origin of adult diseases [5]. A woman's nutritional status is influenced by numerous variables including genetics, environment, lifestyle habits, the presence of disease or physiological stressors, and drug-toxicant exposures [6].

Maternal Nutrition Interventions during Preconception

The objectives of nutritional care in the preconception period are to encourage women to achieve appropriate weight for height and healthful dietary habits.

The interventions during preconception are:

- Macro-nutrient assessment.
- Micro –nutrient deficiency prevention and control through supplementation.
- Nutrition education/counselling [7].

Dietary Intake Prior to Conception

The quality of a woman's diet during pregnancy has an influence on positive fetal and maternal outcomes; therefore, a healthy, balanced diet is important before as well as during pregnancy [8]. Studies of Dutch famine during Second World War revealed the vital need for good preconception nutrition to ensure healthy new-borns. Maternal nutrition 90-120 days prior to conception is believed to be as critical as the early pregnancy nutrition [9].

The role of nutrition in promoting health is well defined. What women eat determines more than just their own health, it is also vital to healthy pregnancies and newborns. Many women are still unaware of how much their nutritional status impacts their pregnancy outcomes, and improving women's eating behaviors should therefore begin during their earlier reproductive years. Preconception care provides opportunities both in the community and healthcare settings to deliver basic interventions such as nutrition, to improve the health of women and their babies. Providing simple nutritional interventions before pregnancy can prevent a significant proportion of maternal and neonatal mortality and morbidity. [10]Not all women have financial or logistical access to a high-quality diet [11].

Nutritional Interventions

Nutritional supplementation during pregnancy is widely used and has been recommended for decades as a strategy to improve the health of the mother and the infant. However, a limitation of this approach is that it is difficult to predict exactly when a pregnancy is conceived and many women do not have contact with health services until the second or third trimester, and therefore do not receive supplementation during the critical early weeks of pregnancy. Maternal nutrition determines the fetal growth and birth weight, and poor nutrition is the source of long-term, irreversible and detrimental consequences of the fetus. Provision of healthy nutrition and supplementation during preconception period in the best health possible at the start of pregnancy, before the crucial time of fetal development and before health problems can lead to adverse maternal outcomes [10]. Preconception care must begin at least three months before planning a pregnancy [12]. Several studies have shown that most women of reproductive age are not getting enough vitamins A, C, B6, and E, folic acid, calcium, iron, zinc, and magnesium in their diet. A case-control study on the risk of orofacial clefts by Krapels et alconcluded that the preconception energy-adjusted intake of vegetable protein, fibre, beta-carotene, vitamin C, vitamin E, iron, and magnesium were all significantly lower in cases compared with controls [13-15].

Micronutrient Supplements

Micronutrients are important in the preconception period since they affect fertility and reproductive function, as well as the early stages of gestation during which fetal development occurs, through various biologic pathways. Evidence supports that women with adequate micronutrient levels had lower risk of miscarriage and NTDs. Additional evidence is needed to determine whether supplementation with other micronutrients, particularly other B-complex vitamins, might further reduce the rates of adverse pregnancy outcomes and congenital birth defects [16].

Iron Supplementation

Maternal iron deficiency in the first trimester of pregnancy has been linked with significant reductions in infant size at birth and perinatal mortality [17]. Multiple trials on iron supplementation during early pregnancy have shown significant reductions in the frequency of infants with low birth-weights.It is only natural to target iron deficiency in women of reproductive age before they conceive and try to have the greatest effect in reducing pregnancy-related consequences [18]. The intake of iron before conception helps to provide adequate reserves that help to prevent anaemia later during pregnancy.

- Women should be counselled on intake of iron rich foods such as liver, red meat, kidney, fish, chicken, millet, ground nuts, and green leafy vegetables.
- Women should be counselled to avoid foods containing iron absorption inhibitors (tea/ coffee) just before, during and shortly after meals, and to consume foods containing caffeine two or more hours before or after iron containing foods or iron supplements.
- Women should be counselled on intake of foods containing iron absorption enhancers just before, during and after meals (e.g. foods rich in vitamin C like oranges, tangerines, mangoes, meat and fish products, tomatoes, green peppers etc.).

- Weekly iron supplementation of 60mg (200mg of iron sulphate) as is recommended for women for three months prior to conception, per the WHO guidelines, 2009 [7].

Folic Acid

Folic acid, a water-soluble B-complex vitamin required for deoxyribonucleic acid synthesis and cell division, because of its proven preventive properties against neural tube defects (NTDs) [19].

The role of folic acid at preconception is to reduce the risk of birth defects of the brain and spine, called neural tube defect (NTD) in the new-born. The neural tube closes during the 4th week of pregnancy - a time when most women may not even know they are pregnant. Because most pregnancies are unplanned, it is especially crucial for all women of childbearing age years to have an adequate intake of folic acid through food diets and/or supplementation.

Those women at high risk of neural tube defect are:

- Those previously affected by folic acid deficiency.
- Those with a family history of NTD or diabetes.
- Who have sickle cell anaemia.
- Who are on anti-epileptic medication [7].
- Hispanic women [20].

Obese Women [20]

Folate levels can be increased by consuming folate-rich foods or ingesting folic acid, a synthetic compound available through dietary supplements and through fortified foods. The major dietary sources of naturally occurring folate are legumes, green leafy vegetables, citrus fruits and juices, and breads and cerealsthat contained folic enriched flour. Folic acid is approximately 1.7 times more bioavailable than folate and therefore has a greater efficiency in impacting folate levels [21].

The current recommended daily intake (RDI) for folic acid is 400Microgram for women of preconception age and 600Microgram during pregnancy [22]. The recommended dose is higher (4 mg) for women who have had a infant with an NTD [23]. Inadequate folate levels have been linked to increased risks of stroke, cancer, and dementia [24]. At least 70% of NTDs could be prevented if the embryo were exposed to protective amounts of folic acid during the critical window of organogenesis [25].

Calcium

Calcium is needed for building bones and teeth, for blood clotting, for regulating nerve and muscle activity and for absorption of iron. Women's bone density diminishes in the first three months of pregnancy as a result of increased calcium uptake by the developing fetus.It is advisable to ensure sufficient calcium intake during preconception to build up calcium reserves in preparation for pregnancy. Women should be counselled to consume foods rich in calcium such as dairy products (yoghurt, milk, and cheese), eggs, fish, beans, soybeans, and cereals like whole millet and rice [7].

The dynamic balance between skeletal calcium storage and fetal nutritional needs can affect the maternal calcium equilibrium adversely. Therefore, if adequate bone has not been built before pregnancy and adequate calcium is not part of the maternal diet, bone can be degraded as calcium is taken from the maternal skeleton. When completing diet history during preconception counselling, it is important to ask about dietary calcium consumption (milk, fortified orange juice, etc.), calcium supplementation, and use of antacids to assess the woman's overall calcium intake. Vitamin D intake is necessary to facilitate calcium absorption [26]. The Institute of Medicine currently recommends 1000 mg/day of calcium for pregnant and lactating women who are 19-50 years old and 1300 mg/day for pregnant and lactating women who are younger than 19 years old [27].

Vitamin D

Vitamin D is a lipid-soluble vitamin important in the metabolism of calcium and phosphorus. It promotes calcium absorption and bone mineralization. It may be obtained from either endogenous production from sun exposure or dietary sources. The major dietary sources are fortified items, particularly milk, orange juice, and some breakfast cereals. Other dietary sources include fatty fish (salmon, mackerel, tuna, and sardine), egg yolks, liver, and cheese [26].

Vitamin D deficiency during pregnancy is reflected in lower maternal weight gain; biochemical evidence of disturbed skeletal homeostasis in the infant; and in extreme situations, reduced bone mineralization, radiologically evident rickets, and fractures [28]. Additionally, vitamin D insufficiency has also been associated in some studies with other health outcomes that affect women, including asthma, diabetes, autoimmune diseases, and certain cancers. Daily requirements may be closer to 1000 IU. Gynaecologists recommend daily consumption of 400-800 IU. Education on vitamin D in the diet and supplementation should be a part of preconception care [29].

Vitamin A Supplementation

Vitamin A is a fat-soluble vitamin found in several forms. Vitamin Afound in foods that come from animals (liver, whole milk) is called preformed vitamin A. It is absorbed in the form of retinol, which is made into retinal and retinoic acid (other active forms of vitamin A) in the body. Vitamin A that is found in fruits and vegetables is called provitaminA carotenoid, which is made into retinol in the body. There is also a synthetic analog (13-cis retinoic acid) isotretinoin, a medication used to treat severe, cystic acne, and related dermatoses. Because vitamin A is lipid soluble, it crosses the placenta easily and has a long half-life. Although normal fetal development requires sufficient vitamin A intake, very high levels of preformed vitamin A (retinoic acid) supplementation has been associated with miscarriage and birth defects that affect the central nervous system and craniofacial, cardiovascular and thymus development [30]. Isotretinoin should not be taken during pregnancy or if there is a possibility of becoming pregnant. The current recommendation is to discontinue such medications such as at least 1 month prior to attempting pregnancy [31].

Vitamin A deficiency occurs either when there is a limited intake of dairy products, carotene-rich vegetables and fruits or, occasionally, with malabsorption syndromes. Vitamin A deficiency during pregnancy is known to result in night blindness, increased risk of maternal mortality, premature birth, intrauterine growth retardation, low birth weight, and antepartum hemorrhage[19]. vitamin A is associated with anemia [20]. and Suharno et al. reported that supplementing pregnant women in their second trimester with both vitamin A (2400 IU) and iron daily for 2 months improved hemoglobin concentrations more than when compared to supplementation with iron or vitamin A alone. [32]Vitamin A also appears to be protective in pregnant women with human immunodeficiency virus/acquired immunodeficiency syndrome. [31]

Dietary sources of vitamin A and beta-carotene (leafy vegetables, carrots, eggs, and dairy products) do not pose a risk of excessive intakes and should be included in a healthy diet. Vitamin A from beta-carotene is not known to increase the risk of birthdefects. [33]During pregnancy, evidence in humans suggests that more than 10,000 IU of vitamin A per day may be teratogenic, resulting in cranial/ neural crest defects [34].

Iodine

Disorder of thyroid function are common among women of childbearing age. Clinicians, often overlook thyroid dysfunction in pregnant women because of nonspecific symptoms and the hyper metabolic state of normal pregnancy. Abnormalities of maternal thyroid function can affect the fetus directly or indirectly. Maternal thyroid hormones are very important during the first trimester for fetal brain development for this reason, women with overt or subclinical hypothyroidism should be treated with adequate replacement therapy in order to be euthyroid. Before pregnancy all women of childbearing age should screened for thyroid function and autoimmune thyroid disease [35].

Iodine deficiency is a universal health problem and is thought to be the most common preventable cause of mental retardation. The iodine requirement during pregnancy is sharply elevated. Severe iodine deficiency during pregnancy causes maternal and fetal hypothyroxinemia 26 which leads to irreversible brain damage with mental retardation and neurologic abnormalities [36]. Although providing adequate iodine in mid-to-late pregnancy improves infant cognitive development, benefits are even greater when iodine is given before or early in pregnancy. Preconception supplementation and attainment of a steady- state of iodine stores before planning a pregnancy would successfully avert the grave consequences associated with iodine deficiency [37].

Preconceptional Weight

Overweight

Tremendous changes have occurred in the demographic and epidemiological profile of women experiencing pregnancy. More women entering pregnancy either overweight or obese.Nutrition in pregnancy in this millennium is very important now as the dietary habits of young women are changing in many societies and pregnant women are increasingly entering pregnancy as overweight. The prevalence of overweight girls is therefore a public health challenge with intergenerational implications. Obesity before pregnancy is linked to childhood weight problems [38].

Adverse outcomes associated with maternal obesity include neural tube defects, preterm delivery, stillbirth, gestational diabetes, hypertensive and thromboembolic disorders, macrosomia, low Apgar scores, postpartum anaemia, caesarean delivery, and shoulder dystocia. Furthermore, women who are obese before conception tend to gain and retain more weight during pregnancy [39]. Prevention of childhood obesity needs to begin before a women becomes pregnant. The study done byNational Institute of Health (NIH) showed a significant relationship between a mother's weight prior to

pregnancy and her child's weight [38].

Possible Interventions

- Need for women empowerment.
- Equality of status in society, in the family, an equal role in making decisions.
- Food security.
- Access to health services.
- Education of women.
- Right to decide about reproduction is fundamental human right [38].

Counselling to support improvements in diet and physical activity are considered first-line interventions. The most successful nonsurgical approaches to weight loss is intensive, weight-focused counselling consisting of more than 1 session per month or multicomponent, intensive interventions that combine nutrition and exercise counselling with supportive, skill-building behaviour interventions. ACOG recommends setting an initial goal of losing 5-10% of total body weight over a 6 month period as Realistic and achievable. Weight loss is not recommended during any pregnancy, irrespective of pregravid weight. Therefore, to minimize the risks of obesity on reproductive outcomes, interventions must occur before pregnancy [40].

For women with a normal prepregnancy BMI, a weight gain of around 0.4 kg/week during the second and third trimesters is recommended. For underweight women, a weight gain of 0.5 kg/ week is the target, whereas for overweight women, 0.3 kg/ week is recommended [41].

Underweight

Health risks of being underweight include nutrient deficiencies heart irregularities, osteoporosis, amenorrhea, and infertility. For women who become pregnant, low pregravidweight is associated with increasedrisks for preterm birth and lowbirthweight, which are all major contributors to poor pregnancy outcomes.

A low prepregnancy BMI may also increase the risk of birth defects such as gastroschisis. A study by Lam et al161 found that infants born to underweight mothers (prepregnancy BMI _ 18.1 kg/m2) were more than 3 times as likely to have gastroschisis compared with infants of normal-weight mothers (prepregnancy BMI 18.1-28.3 kg/m2). In this study, every unit increase in BMI was estimated to decrease the risk for gastroschisis by about 11%. Weight gain in pregnancy cannot overcome the risks associated with a low pregravid weight. Therefore, women should be counselled during the preconceptional period on the potential risks of their weight on fertility and on pregnancy outcome [42].

Advise on Nutritional Requirements during Preconception

No single food contains all the nutrients the body needs. A variety of foods should be consumed at every meal. These include:

- Energy giving foods, such as cereals like maize meals, rice, millet, sorghum, roots and tubers e.g. potatoes, cassava, and plantains like bananas etc.
- Protein giving foods include animal products such as meat, milk, eggs, and fish, and plant products such as legumes like beans, peas, soya, and groundnuts.
- Minerals and vitamin rich foods such as fruits and vegetables [7].

Discussion

Motherhood is the dream of every women. Parents wants a perfect baby. Physician cannot fulfil this goal every time. Schrender states that preconception care shift this responsibility back to the parents [43]. Motive of medicine is primary prevention and preconception counsellingis exampleof this concept. It allows interventions to prevent the complication [44]. Preconception care includes risk assessment and education. Maternal health is optimized preconceptionally [45].

The preconception micronutrient status of women is also crucial. The main reasons for low prevalence of use in low socioeconomic groupinclude low maternal education and socioeconomic status; young maternal age; and unplanned pregnancy. It is necessary therefore to improve awareness and use of folic acid supplements among all women of reproductive age so that even women with unplanned pregnancies are protected. Those with personal counseling in addition to mass campaigns have been shown to be more effective. Inclusion of a specific health claim, such as that folic acid prevents birth defects, is more successful in increasing uptake and use. Fortification has thus been proposed as a means to prevent approximately half of all NTDs occurring annually and 13% of neonatal mortality attributed to NTDs, especially in areas with high prevalence of NTDs. Public health policy in some countries now mandates that staple foods, such as flour, be fortified

with folic acid.

Future trials need to center on how pre-pregnancy provision of iron, vitamin A and iodine supplements could possibly lower adverse pregnancy related outcomes and the best way of implementing supplementation programs for the general population, especially targeting women of reproductive ages [46].

Young women in the current times are depriving themselves of sound nutritional habit to meet social images. Primary care attempts to address the problems through education and counselling. Poor nutrition due to poverty may be the single greatest risk factor for many future mothers. A women should attempt to reach her ideal body weight before conception.Eating disorder may cause nutrient deficiencies' that should be corrected before pregnancy. Women should also be informed that vitamin excesses, especially fat soluble vitamins, may be toxic and possibly teratogenic [47].

Nutrition Education/Counselling during Preconception

Health workers should provide nutrition education and counselling prior to pregnancy in order to promote maternal health and good pregnancy outcomes. Nutrition education should be conducted for individuals, communities, schools, in outreaches and at health facilities. The counselling should include:

- Variety of foods.
- Frequency of foods.
- Hygiene.
- Focus on locally available foods.
- Importance of the adequate nutrition before pregnancy.
- Folic acid supplementation.
- Prevention of anaemia [7].

Balanced protein energy supplementation and appropriate micronutrient supplementation could reduce the risk of pre-pregnancy underweight on adverse perinatal outcomes. Difficulty in maintaining healthy weight and eating habits are not due to lack of willpower, but also environmental pressures and gender equality – where less importance is given to a girl child and women in general. It is therefore important to work with communities particularly with husband and significant others from families such as mother-in-law to improve their support for the women in reproductive years. Promotion of improved diet and exercise/workload with the help of a support system can help improve weight [10].

Conclusion

Healthcare providers should be encouraged to provide preconception care to all adolescent girls, women and couples of reproductive age. A woman's nutritional status affects her health and that of her baby throughout pregnancy. Preconception care, as a means to reduce risk and improve the health of women and their children. While dietary habits are established in childhood, nutrition can be improved through intervention in the preconception period. Food fortification with micronutrients, along with intensive promotional campaigns and counselling by healthcare providers could increase coverage of daily multivitamin supplementation

Preparing for a healthy pregnancy is not the sole responsibility of either the mother or the family. Individual life patterns, social support, networks and social living conditions are all important factors in conceiving, giving birth to and raising healthy children. Thus it is critical that families are supported in safe and caring communities and societies [45]. A healthy baby and a healthy mother are valued hopes and dreamsof families and cultural heritage across the world. Nutritional interventions prior to conception can have a tremendous impact on pregnancy outcome [48].

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