Role of Healthy food in Prevention of Neural Tube Defects: A Review

Himesh Soni1*, Sarvesh Sharma1, Jitender K Malik2 and Satish K. Sarankar3

1D.H.S. Bhopal Madhya Pradesh, India
2Bharat Institute of Pharmacy, Sonepat Haryana, India
3IES Institute of Pharmacy, Ratibad, Bhopal, India

DOI: 10.36348/sjmps.2020.v06i01.003 | Received: 30.12.2019 | Accepted: 06.01.2020 | Published: 11.01.2020

*Corresponding author: Himesh Soni
Email: himeshsoni@rediffmail.com

Abstract

Neural tube defects (NTDs) are general complex congenital malformations consequential from failure of the neural tube closure during embryogenesis. It is recognized that folic acid supplementation decreases the prevalence of NTDs, which has led to national public health policies regarding folic acid. To build your healthful pregnancy the choice diet includes a variety of nutrient-packed foods from the following groups: Fruits, Vegetables, Dairy foods, Protein, Whole grains etc. The present review focus on the some of the folic acid rich supplement food which helps to healthful pregnancy and lower the risk of congenital birth defect (NTDs).

Keywords: Neural tube defects (NTDs), folic acid (folate), Legumes & Fruits.

INTRODUCTION

Herbal drugs play an important role in health care programs chiefly in developing countries. Ancient Indian literature incorporates a extremely broad definition of medicinal plants to be potential sources of medicinal substances. Diet is believed to play an important role in prevention of diseases. Foods that contain components active in disease prevention and that serve specific bodily functions, in addition to being nutritious, are defined as functional foods [1]. Neural tube defects (NTDs) are general complex congenital birth defect resulting from failure of the neural tube closure during embryogenesis. It is recognized that folic acid supplementation decreases the prevalence of NTDs. NTDs caused by problems in closing of the neural tube during development. It may influence any part of the brain or spinal cord [2].

Types of NTDs: Spina bifida (most) common and Anencephaly i.e “open” NTDs in which the neural tissue is exposed and “closed” NTDs with the neural tissue covered by tissue [3, 4].
Spina Bifida

It also called “open spine”
Affects vertebrae and spinal cord
Main types:
- Spina bifida occulta
- Spina bifida cystica / aperta
- Meningocele
- Myelomeningocele

Anencephaly

- It mainly affected brain and skull development
- Top part of head and brain does not form
- Patients are blind, deaf, unconscious
- Patients do not usually survive longer than days

Neural tube defects are birth defects that are characterized by abnormalities in the spine, brain or spinal cord of the developing foetus. It is one of the most common forms of birth defects in babies worldwide. These defects occur during the first month of the pregnancy and are detected in the first trimester itself. Various cause of NTDs [5].

Folate(vitamin B9) is a water-soluble B vitamin that occurs naturally in food. Folate gets its name from the Latin word “folium” for leaf. Folic acid (pteroylmonoglutamic acid), which is the most oxidized and stable form of folate, is the form of vitamin supplements. Structurally folic acid is fusing of a p-aminobenzoic acid molecule linked at one end to a pteridine ring and at the other end to one glutamic acid molecule[6].

Folate is significant for nucleotide synthesis, and preconceptional intake of dietary folic acid (FA) is attributed with reduced incidences of neural tube defects in infants [7]. Previous investigation has been suggested that specific folates deficiency at the cellular level may be responsible for NTDs due to disturbed folates bioavailability [8]. Folates also related to NTD risk through their roles in nucleotide synthesis [9]. The body needs folate to form blood. During first trimester of pregnancy (first 4 weeks of pregnancy) folate is essential for the growth of the baby’s brain, spine and skull. Daily need of 0.4 milligrams (400 micrograms) of folic acid every day for at least 3 months is necessary during pregnancy. The present review spotlight on the some of the folic acid rich supplement food which helps to healthful pregnancy and lower the risk of congenital birth defect (NTDs).

Folate Rich Foods: Necessary during Pregnancy

Asparagus

Asparagus racemosus (Shatavari) Asparagus racemosus is the most usually used in traditional medicine. In the ancient literature of Ayurveda the use of Asparagus racemosus was mentioned. It is generally used to rectify the gynecological problems like irregularities in menstrual cycle and sexual dysfunction [10]. Asparagus contains about 128-141µg of folic acid [11].
Chukander (Beet root)
Scientifically Beet root known as Beta vulgaris belonging to this family Chenopodiaceae. It contains about 80µg (fresh beetroots per 100 g) of folic acid [12].

Broccoli
Broccoli biologically known as Brassica oleracea (Brassicaceae) is recommended in case of vitamin A deficiency (xerophthalmia), infantile scurvy (vitamin C deficiency) and anemia resulting from folate deficiency [13]. It contains about 63 µg of folic acid [14].

Cauliflower
Brassica species are incredibly rich in health-promoting phytoceuticals, including phenolic compounds, vitamin C, and minerals. Brassica oleracea commonly known as “Phoolgobhi”. Cabbage has prevalent use in traditional medicine due to its antioxidant, anti-inflammatory and antibacterial properties, in improvement of symptoms associated with gastrointestinal disorders (gastritis, peptic and duodenal ulcers, irritable bowel syndrome) [15]. Folate content is about 57 µg/100g [16].

Asparagus racemosus

Peas
Pisum sativum particularly green and yellow cotyledon dry peas, also called as smooth peas or field peas. It contain various phytoceuticals with numerous medicinal values include polyphenolics, in coloured seed coat types in particular, which may have antioxidant and anticarcinogenic activity, saponins which may exhibit hypocholesterolaemic and anticarcinogenic activity, and galactose oligosaccharides which may exert beneficial prebiotic effects in the large intestine [17]. Folate content is about 65 µg/100g [16].

Soybean
The soybean (Glycine max) is a species of legume. The beans contain considerable amounts of α-linolenic acid, omega-6 fatty acid and the isoflavones like genistein and daidzein. Dry soybean contain 36% protein, 19% oil, 35% carbohydrate (17% of which dietary fiber), 5% minerals and several other components including vitamins. A number of investigation demonstrated the various pharmacological potential like hypocholesterolaemic effect, anticarcinogenic effects of soy beans, and the ability of soy beans to lower the risk of osteoporosis , cardiovascular disease as well as relieving menopausal symptoms , renal disease beneficial effect against diabetes and antioxidant activity [19]. Folate content is about 165 µg/100g [20].
Soybean

Parsley

Petroselinum crispum has been used as carminative, gastro tonic, antiseptic of urinary tract, diuretic, anti-dote, anti-urolithiasis and anti-inflammatory and for the treatment of amenorrhea, dysmenorrhea, gastrointestinal disorder[21]. Folate content is about 152 µg/100g [22].

Spinach

Spinacia oleracea is commonly known as Spinach (English), Chhurika (Sanskrit), Palak (Hindi). Spinach has a high nutritional value and is tremendously rich in antioxidants, especially when fresh, steamed, or quickly boiled. It is a prosperous source of vitamin A (lutein), vitamin C, vitamin E, vitamin K, magnesium, manganese, folate, iron [23]. Folate content is about 194 µg/100g [24].

Cowpeas

Vigna unguiculata (cowpea) is a widely cultivated legume in central Asia. Cowpea seeds contain bioactive compounds which is beneficial to human health. Phenolic compounds, the most important group of phytocuticals in cowpea having the potential to protect the body against chronic diseases [25]. Folate content is about 168 µg/100g [26].

Collards

Brassica juncea (Cruciferae) leaves are used in a variety of folk medicines as stimulants, diuretics and expectorants as well as a spice. The chief pungent chemical constituent of such commercialized oils is Allyl isothiocyanate. This isothiocyanate is considered to be the most significant cancer chemo-preventive phytochemical with additional potential health benefits [27]. Folate content is about 129 µg/100g [28].

Avocado

Persea americana (Lauraceae) also known as the alligator pear. Major component is vitamin E has been reported to elicit an antioxidant against the reproductive disorders [29]. Hass Avocado contains about 60mg of Folate [30].
Sweet oranges

_Citrus_ is the biggest genus in the family Rutaceae. _C. sinensis_ (Sweet orange). _C. sinensis_ contains about 15-20 µg of Folate [31].

**Pharmacology of Folic acid [32]**

**SUMMARY**

Neural tube defects (NTDs) are amongst widespread birth defects contributing to infant mortality and serious disability. Folic acid plays key role biosynthesis of nucleotides. Deficiency of folate leads failure to biosynthesize the proper nucleotides during early pregnancy, which disrupt the neural plate depletion and causes NTDs. Folic acid–containing supplement consumption during one trimester of pregnancy can be preventing NTDs proved clinically. The increased consumption of food folate would prevent NTDs as efficiently as a daily vitamin supplement containing 400 µg of folic acid which require additional intake of folate rich foods. Vitamin B9 is a water-soluble vitamin that has no recognized toxicity. Higher doses of folic acid can correct the pernicious. Diet is believed to play an important role in disease prevention. They may include vegetables or fruits. The present assessment spotlight on the some of the folic acid rich supplement food which helps to healthful pregnancy and lower the risk of congenital birth defect (NTDs).

**REFERENCE**

1. Himesh, S. O. N. I., Singhai, A. K., Sarvesh, S. H. A. R. M. A., Nayak, G., & Priyanka, S. W. A. R. N. K. A. R. (2011). Quantification of ascorbic acid in salad components. *International Journal Of Current Pharmaceutical Research*.
2. Canick, J.A. (2003). Prenatal screening for open neural tube defects. *Clin Lab Med*, 23:385-94.
3. Northrup, H., Volcik, K.A. (2000). Spina bifida and other neural tube defects. *Curr. Probl. Pediatr.* 30:313–332.
4. Chen, C. P. (2008). Prenatal diagnosis, fetal surgery, recurrence risk and differential diagnosis of neural tube defects. *Taiwanese Journal of Obstetrics and Gynecology*, 47(3), 283-290.
5. Rana, M., Bisht, S. S., Rana, A. J., & Upadhyay, J. (2017). Neural Tube Defects, Its Etiology: Environmental Exposures and Genes, Possible Risk Factors. *Journal of Pharmaceutical Sciences and Research*, 9(2), 131.
6. Rico, P. (2012). Lourdes García-Fragoso1, Inés García-García1 and Carmen L. Cadilla2. *Neural Tube Defects: Role of Folate, Prevention Strategies and Genetics*, 1.
7. Barua, S., Kuizon, S., & Junaid, M. A. (2014). Folic acid supplementation in pregnancy and implications in health and disease. *Journal of biomedical science*, 21(1), 77.
8. Piedrahiita, J. A., Oetama, B., Bennett, G. D., Van Waes, J., Kamen, B. A., Richardson, J., ... & Finnell, R. H. (1999). Mice lacking the folic acid-binding protein Folbp1 are defective in early embryonic development. *Nature genetics*, 23(2), 228.
9. Barber, R. C., Lammer, E. J., Shaw, G. M., Greer, K. A., & Finnell, R. H. (1999). The role of folate transport and metabolism in neural tube defect risk. *Molecular genetics and metabolism*, 66(1), 1-9.
10. Shaha, P., & Bellankimath, A. (2017). Pharmacological profile of Asparagus racemosus: A review. *Int. J. Curr. Microbiol. App. Sci*, 6(11), 1215-23.
11. Food Sources of Folate. (2005). “Canadian Nutrient File”.
12. Yashwant, K. (2015). Beetroot: A Super Food. *IJESTA*, 1(3),23.
13. Owis, A. I. (2015). Broccoli; the green beauty: a review. *Journal of Pharmaceutical Sciences and Research*, 7(9), 696.
14. Holasova, M., Fiedlerova, V., & Vavreinova, S. (2008). Determination of folates in vegetables and their retention during boiling. *Czech journal of food sciences*, 26(1), 31.
15. Satish, S., & Shabaraya, A.R.(2019). A review on pharmacological activities of bassica oleracea. *International Journal of Pharma and Chemical Research*, 5(1),5.
16. Jagdish, S. (2018). Folate Content in Legumes. *Biomed J Sci & Tech Res*, 3(4), 3477.
17. Dahl, W. J., Foster, L. M., & Tyler, R. T. (2012). Review of the health benefits of peas (Pisum
sativum L.). *British Journal of Nutrition*, 108(S1), S3-S10.

18. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

19. Kanchana, P., Santha, M. L., & Raja, K. D. (2015). A review on Glycine max (L.) merr. (Soybean). *World Journal of Pharmacy and Pharmaceutical Sciences*, 5(1), 356-371.

20. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

21. Farzaei, M. H., Abbasabadi, Z., Ardekani, M. R. S., Rahimi, R., & Farzaei, F. (2013). Parsley: a review of ethnopharmacology, phytochemistry and biological activities. *Journal of traditional Chinese medicine*, 33(6), 815-826.

22. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

23. Metha, D., & Belemkar, S. (2014). Pharmacological activity of spinacia oleracea linn.- a complete overview. *Asian Journal of Pharmaceutical Research and Development*, 83-93.

24. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

25. Sombié, P., Compaoré, M., Coulibaly, A., Ouédraogo, J., Tignéré, J. B., & Kienédéréogo, M. (2018). Antioxidant and phytochemical studies of 31 Cowpeas (Vigna unguiculata (L. Walp.)) Genotypes from Burkina Faso. *Foods*, 7(9), 143.

26. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

27. Kumar, V., Thakur, A. K., Barothia, N. D., & Chatterjee, S. S. (2011). Therapeutic potentials of Brassica juncea: an overview. *Tang [Humanitas Medicine]*, 1(1), 2-1.

28. Singh, J. (2018). Folate content in legumes. *Biomedical Journal*, 2, 6.

29. Cicek, N., Eryilmaz, O. G., Sarikaya, E., Gulerman, C., & Genc, Y. (2012). Vitamin E effect on controlled ovarian stimulation of unexplained infertile women. *Journal of assisted reproduction and genetics*, 29(4), 325-328.

30. Ranade, S. S., & Thiagarajan, P. (2015). A review on Persea americana Mill. (avocado) - its fruits and oil. *Int. J. PharmTech Res*, 8(6), 72-77.

31. Turner, T., & Burri, B. (2013). Potential nutritional benefits of current citrus consumption. *Agriculture*, 3(1), 170-187.

32. Krebs, M. O., Bellon, A., Mainguy, G., Jay, T. M., & Frielings, H. (2009). One-carbon metabolism and schizophrenia: current challenges and future directions. *Trends in molecular medicine*, 15(12), 562-570.