

INTRODUCTION

India is the most potential market for nutraceutical products. Nutritional supplements by definition are concentrated sources of nutrients intend to supplement the diet but not replace it. It includes vitamins, minerals, protein, mineral complexes, enzymes etc. Improved standard of living, increasing health consciousness, education, easy availability and better income have compelled us to think of the fine line between use and indiscriminate use of these supplements.

Vitamins and minerals has shifted from trying to prevent deficiencies to taking higher amounts of them in an effort to enhance health. The need of hour is to answer a question whether daily use of vitamin, mineral, anti-oxidants and probiotics are helping or causing detrimental effects.

INDIAN SCENARIO

Accounts for 1.5% of global pharmaceutical market. One-Fifth of Indian population lack purchasing power to consume a diet which is rich in calories and sufficient to meet RDA causing a burden of Malnutrition. Sports nutrition is gaining importance in India. Various fitness centers are contributing to increase demand of vitamins and minerals. Federation of Indian Chambers of Commerce and Industry (FICCI) stated nutrition related risk factors contribute to more than 40% deaths in developing countries including India.

SPECIFIC STRATA OF POPULATION LIKELY TO BE BENEFITED ARE

- Women of childbearing age (need extra calcium and iron)
- Pregnant or lactating women
- Children and teenagers with irregular eating habits
- Seniors
- Vegetarians or vegans (may be deficient in key nutrients)
- Dieters or people avoiding certain food groups (may be deficient in key nutrients)
- People with eating disorders or medical conditions (deficiency diseases, absorption problems, lactose intolerance, etc.)
- People who often eat processed and fast food
- Some people are at risk of micronutrient deficiencies due to excessive losses (e.g., through

hemodialysis), abnormal metabolism (e.g., genetic polymorphisms, alcoholism, conditions that impair fat absorption), and/or inadequate synthesis (e.g., insufficient sunlight exposure to allow vitamin D synthesis).

Inadequate micronutrient intake, sometimes even at borderline levels of deficiency, has been linked to stunted growth and neurocognitive deficits, as well as increased risks of various symptoms and conditions. Most nutrients act in all tissues, and all tissues need all nutrients; therefore, inadequate intakes may adversely affect every body system, but with more pronounced effects in some than others.

APPROPRIATE USE

- B-Complex is involved in processing fats & carbohydrates for energy production and formation of hemoglobin in red blood cells.
- Vitamin B₁₂ can reverse anemia.
- Vitamins B₁, B₆, B₁₂ affect formation of serotonin, neurotransmitter involved in relaxation.
- Vitamin D is recommended for breastfeeding babies and elderly. Low vitamin D is associated with so many diseases like heart diseases, diabetes, osteoporosis etc.
- Vitamin K injections in newborns prevent bleeding events. Vitamin K2 has recently been revealed as an important nutrient in protecting against heart disease. It does this by putting calcium in the bones and teeth where it belongs, and not in the arteries and soft tissue.
- Choline involved in acetylcholine synthesis which is a neurotransmitter whose reduction causes fatigue.
- Antioxidants – Vitamin C, E, beta-carotene and coenzyme Q₁₀ have shown to improve exercise performance and prevent exercise-induced muscle damage but in individuals deficient of them.

USE OF MICRONUTRIENTS**Zinc**

Zinc is a metal. It is called an “essential trace element” because very small amounts of zinc are necessary for human health. Zinc is used for treatment and prevention of zinc deficiency and its consequences, including stunted growth and

410 acute diarrhoea in children, and slow wound healing. It is also used for boosting the immune system, treating the common cold and recurrent ear infections, and preventing lower respiratory infections. It is also used for malaria and other diseases caused by parasites. Some people use zinc for an eye disease called macular degeneration, for night blindness, and for cataracts. It is also used for asthma; diabetes; high blood pressure; acquired immunodeficiency syndrome (AIDS); and skin conditions such as psoriasis, eczema, and acne.

Side Effect of Zinc

Zinc is likely safe for most adults when applied to the skin, or when taken by mouth in amounts not larger than 40 mg daily. Routine zinc supplementation is not recommended.

Zinc is possibly safe when taking by mouth in doses greater than 40 mg daily. There is some concern that taking doses higher than 40 mg daily might decrease how much copper the body absorbs. Decreased copper absorption may cause anemia. Taking more than 100 mg of supplemental zinc daily or taking supplemental zinc for 10 or more years doubles the risk of developing prostate cancer.

Pregnancy and breast-feeding: Zinc is likely safe for most pregnant and breast-feeding women when used in the recommended daily amounts (RDA). However, zinc is possibly unsafe when used in high doses by breast-feeding women and likely unsafe when used in high doses by pregnant women. Pregnant women over 18 should not take more than 40 mg of zinc per day; pregnant women age 14 to 18 should not take more than 34 mg per day. Breast-feeding women over 18 should not take more than 40 mg of zinc per day; breast-feeding women age 14 to 18 should not take more than 34 mg per day.

Alcoholism: Long-term, excessive alcohol drinking is linked to poor zinc absorption in the body.

Diabetes: Large doses of zinc can lower blood sugar in people with diabetes. People with diabetes should use zinc products cautiously.

Hemodialysis: People receiving hemodialysis treatments seem to be at risk for zinc deficiency and might require zinc supplements.

HIV (human immunodeficiency virus)/AIDS: Use zinc cautiously if you have HIV/AIDS. Zinc use has been linked to shorter survival time in people with HIV/AIDS.

Chromium

Chromium is a mineral. It is called an “essential trace element” because very small amounts of chromium are necessary for human health. There are two forms of chromium: trivalent chromium and hexavalent chromium. The first is found in foods and supplements and is safe for humans. The second is a known toxin that can cause skin problems and lung cancer.

Chromium is used for improving blood sugar control in people with prediabetes, type 1 and type 2 diabetes,

and high blood sugar due to taking steroids and HIV treatments. It is also used for depression, Turner’s syndrome, polycystic ovary syndrome (PCOS), lowering “bad” cholesterol, raising “good” cholesterol in people taking heart medications called beta blockers, metabolic syndrome, heart attack, schizophrenia, bipolar disorder, and binge eating disorder.

Diabetes. Some evidence shows that taking chromium picolinate (a chemical compound that contains chromium) by mouth, either alone or along with biotin, can lower fasting blood sugar, lower insulin levels, and help insulin work in people with type 2 diabetes. Also, chromium picolinate might decrease weight gain and fat accumulation in people with type 2 diabetes who are taking a class of antidiabetes medications called sulfonylureas.

Some research shows that taking 15-200 mcg of chromium daily for 6-12 weeks lowers low-density lipoprotein (LDL or “bad”) cholesterol and total cholesterol levels in people with slightly high or high cholesterol levels.

Copper

Copper is a mineral. It is found in many foods, particularly in organ meats, seafood, nuts, seeds, wheat bran cereals, grain products, and cocoa products. The body stores copper mostly in the bones and muscles. The liver regulates the amount of copper that is in the blood. Copper is used as medicine. Copper is used for treating copper deficiency and the anemia it may cause. Having too little copper (copper deficiency) is rare. It sometimes occurs in people who get too much zinc from diet or supplements, have intestinal bypass surgery, or are fed by feeding tubes. Malnourished infants can also have copper deficiency. Copper is also used for improving wound healing, and treating osteoarthritis and brittle bones (osteoporosis). There is no evidence that people who eat a normal diet need copper supplements. Not even athletes need extra copper if they have a good diet. Copper is necessary for producing and storing iron. Taking copper in combination with zinc, manganese, and calcium might slow bone loss in older women.

5 MICRONUTRIENTS THAT MAY HELP REDUCE BLOOD SUGAR

Overwhelming scientific evidence confirms that vitamin, mineral and antioxidant deficiencies suppress immune function and contribute to chronic inflammatory degenerative processes, such as arthritis, cancer, Alzheimer’s, cardiovascular disease and type 2 diabetes. We have seen over and over the myriad of scientific studies that demonstrate the ability to prevent, treat and even reverse type 2 diabetes through diet and lifestyle.

Unfortunately, however, serious nutritional deficiencies can occur even with a healthy eating plan due to many possible factors, including inadequate absorption of nutrients due to co-morbidities, toxins in our environment that may interfere with transport of nutrients, or nutrient-drug interactions as a result of the use of both prescription and over-the-counter medications. Metformin, for

example, used by many people with type 2 diabetes and pre-diabetes, has been shown to lower vitamin B₁₂ and folic acid, which can then lead to an increase in homocysteine levels, a major risk factor for cardiovascular disease. A folate deficiency has also been associated with diabetes co-morbidities of retinopathy and renal failure. Many other pharmaceutical medications and over-the-counter treatments have been implicated in causing micronutrient deficiencies.

Let's take a look at just a few of the micronutrients that are often inappropriately balanced in our diets and in inappropriate amounts or forms in over-the-counter multi-vitamin/mineral supplements, which may have an effect on glucose metabolism and its consequences.

Alpha-Lipoic Acid

This is an antioxidant that has been shown to regenerate other antioxidants, such as glutathione, vitamin E and vitamin C, and to prevent protein glycosylation. Alpha-lipoic acid has been shown to enhance glucose uptake in skeletal muscle tissue, thus improving glucose regulation in people with diabetes mellitus. It has also been shown to be effective in the treatment of peripheral neuropathy, a common complication in diabetes.

Chromium

This trace mineral is fundamental in proper insulin function and is believed to facilitate the attachment of insulin to the cell's insulin receptors. A lack of chromium can result in insulin resistance, which leads to elevated blood levels of insulin and glucose, resulting in diabetes and cardiovascular complications.

Vitamin D

Children who received 2000 IU vitamin D during the first year of life were found to have a reduced risk of developing type 1 diabetes, compared with children who were not supplemented with vitamin D. Because vitamin D modulates calcium, people with diabetes (both type 1 and type 2) have a higher risk for bone fractures, and vitamin D deficiency has clearly been associated with lower bone density. People with a low vitamin D are also at a higher risk of insulin resistance and metabolic syndrome. Vitamin D is essential for normal insulin release by increasing transmembrane calcium movement in islet cells. Vitamin D-dependent calcium binding protein has been detected in pancreatic tissue and vitamin D receptors have been identified in pancreatic islet cells. Sixty- to 65% of the time, when tested, vitamin D is deficient.

Riboflavin

Many people with diabetes have abnormal riboflavin metabolism, which is often overlooked. Even people taking over-the-counter supplements containing riboflavin, may not be getting adequate dosing because these over-the-counter supplements usually do not contain the proper form of riboflavin, which should be riboflavin 5-phosphate. Riboflavin is important for antioxidant function, working through the pathway of making more glutathione.

Niacin

Niacin acts by protecting pancreatic beta cells from autoimmune destruction. Keep in mind that this is not the nicotinic acid form of niacin used for lowering cholesterol and triglycerides, but instead the amide form of niacin (nicotinamide), which does not cause flushing. Niacin may also act as a weak antioxidant of nitric oxide radicals, but its most significant function related to diabetes is its involvement with the glucose tolerance factor (GTF). Niacin may also retard the development of nephropathy, therefore supplementation in persons with diabetes may be appropriate.

SENSIBLE SUPPLEMENTATION

When using any nutritional supplementation, you must take a sensible approach to avoid risks and side effects:

- Start low and go slow but give it a honest try for at least one month
- Try one new supplement at a time (every 3-4 weeks)
- Only take what you need (not every potential supplement)
- Test your blood sugar often to monitor effects
- Don't take at the same time as your other medications
- Purchase only quality products and avoid supplements with artificial sweeteners, artificial colors, and binders.

PROBIOTICS: HEALTH BENEFITS, FACTS, RESEARCH

Probiotics are microorganisms that offer some form of health benefit to the host - they can be found in various different foods. Probiotics are believed to play very important roles in regulating proper intestinal function and digestion - by balancing intestinal microflora.

These 'good bacteria' are considered to be "live microorganisms which when administered in adequate amounts confer a health benefit on the host", according to the WHO.

Probiotics are normally consumed in fermented foods with active live cultures such as yogurt. There are many different strains of probiotics, but the most common strains available today in are Lactobacillus and Bifidobacterium.

WHAT ARE THE HEALTH BENEFITS OF PROBIOTICS?

It should be noted that many of the possible health benefits of probiotics still require more scientific research to be proven.

1. Diarrhoea: Certain strains of probiotics have demonstrated positive results in treating diarrhoea and gastroenteritis. According to a report published in the Journal of Pediatric Gastroenterology and Nutrition, probiotics are "useful in the prevention or treatment of several gastrointestinal disorders", such as infectious diarrhea, antibiotic diarrhoea, and traveler's diarrhoea.

One study published in the Journal of Pediatrics,



Fig. 1: Yogurt is a popular source of probiotics

concluded that *Lactobacillus* species are a safe and effective form of treatment for children with infectious diarrhea. The researchers concluded that “Prophylactic use of *Lactobacillus* significantly reduced the risk of nosocomial diarrhea in infants, particularly nosocomial rotavirus gastroenteritis.”

2. Brain function: Probiotics may be beneficial for brain function. Researchers at UCLA found that brain function improved among healthy women who regularly consumed probiotic-containing yogurt (Figure 1).

In addition, probiotic bacteria might have the potential to change brain neurochemistry and treat anxiety and depression-related disorders, according to a study published in the journal *Proceedings of the National Academy of Sciences (PNAS)*.

3. Cholesterol: Research presented at the American Heart Association’s Scientific Sessions in 2012 revealed that a formulation of *Lactobacillus reuteri* NCIMB 30242, is able to reduce blood levels of LDL or “bad” cholesterol.
4. Blood pressure: Some studies have found that milk fermented with strains of LAB may help lower blood pressure.
5. Irritable bowel syndrome: There is growing evidence that probiotics can help treat IBS (irritable bowel syndrome). Two review articles, published in *Nutrition in Clinical Practice*, examined the therapeutic approaches to irritable bowel syndrome and found that probiotics, specifically *Bifidobacterium infantis* 35624 (*Bifantis*®), are very effective at managing IBS.
6. Infection: A study published in the prestigious scientific journal *PNAS (Proceedings of the National Academy of Sciences)*, found that probiotic bacteria can protect against bacterial infection.

The research was the first of its kind to demonstrate that *Lactobacillus salivarius* offered significant protection against *Listeria* infection.

7. Psoriasis and Chronic Fatigue Syndrome: Scientists at University College Cork, Ireland, reported in the journal *Gut Microbes* that *Bifidobacterium infantis* 35624 may also have benefits for patients with psoriasis and chronic fatigue syndrome.

Bifidobacterium infantis 35624 is a probiotic available in the USA for fortifying the digestive system.

8. The evidence showed probiotics may be effective towards prevention and management of T1D and T2D.

RECENT DEVELOPMENTS ON PROBIOTICS FROM MNT NEWS

Probiotic formula may hold key to cow’s milk allergy.

Food allergies are growing in prevalence in developed countries, and 3% of children globally are allergic to cow’s milk. New research carried out on children with cow’s milk allergy has shown that structural differences in gut bacteria may be the reason why some children do not acquire tolerance.

COMMON MYTH

- Supplements are natural, safe and better.
- Good at a dose so better at a larger dosage.
- Desire to improve overall health.
- Filling gaps of our diet.
- Taking a multivitamin make us live longer or perform better
- Has been used for thousands of years, so must work

MISCONCEPTIONS

- Multivitamin reduces heart problems
- Lowers cancer risk
- They replace healthy diet
- Prevent strokes

Various studies have shown no difference in rates of another heart attack, the need for hospitalization or rates of stroke and early death between vitamin-takers and placebo-takers.

VARIOUS STUDIES

The U.S. Preventive Services Task Force (USPSTF) Systematic Review

They studied “Vitamin and Mineral Supplements in the Primary Prevention of Cardiovascular Disease and Cancer: An Updated Systematic Evidence Review for the U.S. Preventive Services Task Force”. They intended to examine the evidence for vitamin and mineral supplementation in community-dwelling, nutrient-sufficient adults. They studied the effect of supplementation on two major killers: cardiovascular disease (CVD) and cancer.

Overall, multivitamins were found to have no effect on cardiovascular disease or cancer risk. If there is an actual effect, it’s too small to measure in these trials, and too small to be meaningful.

The French Supplémentation en Vitamines et Minéraux Antioxydants (SU.VI.MAX) RCT evaluated a supplement containing ascorbic acid 120 mg, vitamin E 30 mg,

β -carotene 6 mg, selenium 100 μ g, and zinc 20 mg. This supplement was associated with a 31% reduction in overall cancer incidence and a 37% reduction in overall mortality in men (ages 45–60 years), but not in women (ages 35–60 years), after a median intake of about 7.5 years.

One of the Linxian trials, conducted in relatively healthy persons, found that supplementation with a combination of β -carotene 15 mg/d, vitamin E 30 mg/d, and selenium 50 μ g/d for 5 years was associated with a trend toward a 7% lower risk of cancer and significant reductions in mortality (9% overall; 13% cancer specific). Long-term follow-up of this study indicated that the benefits of taking MVMs persisted for up to 10 years after active supplementation had ceased.

The double-blind, randomized, placebo-controlled Heart Outcomes Prevention Evaluation (HOPE) and 7-year open-label HOPE-The Ongoing Outcomes extension found significant increases in risk of heart failure and related hospitalization associated with vitamin E supplementation (400 IU/d) in high-risk people \geq 55 years of age.

MVM supplements were associated with cardiovascular benefits in the Stockholm Heart Epidemiology Program (SHEEP), a large Swedish population-based case-control study. SHEEP compared adults aged 45 to 70 years who had no previous history of MI with those who had experienced a first MI and survived $>$ 28 days. Regular use of dietary supplements, 80% of which were MVM supplements, was associated with a significant 22% reduction in risk of MI in men and a significant 33% reduction in risk of MI in women compared with nonuse after controlling for consumption of fruit, vegetables, and fiber.

In the randomized Age-Related Eye Disease Study (AREDS), over a median of 6.3 years, high doses of 3 vitamins with antioxidant properties (500 mg/d vitamin C, 400 IU/d vitamin E, and 15 mg/d β -carotene) with zinc (80 mg zinc oxide) significantly reduced the risk of progression to advanced age-related macular degeneration (AMD) by 28% and reduced the risk of any lens opacity by 16% and of nuclear cataract by 25%.

A meta-analysis of 10 RCTs (N = 3,200) concluded that daily MVM supplement use by cognitively intact adults significantly improved immediate free recall memory, with the strongest effect seen for MVM supplements with more constituents, but that MVM supplements had no significant effects on delayed free recall memory or verbal fluency.

The Physicians' Health Study II (PHS II) Feb 2000

The PHS II was a massive study designed to study the effects of vitamins on a number of chronic diseases. This paper reported on the effects of a daily multivitamin on cognition, a secondary outcome in the study. The PHS II recruited 5947 male physicians, aged 65 or older. Patients were randomized to beta-carotene or placebo; synthetic vitamin E (400IU) on alternate days, or placebo; vitamin

C 500mg daily, or placebo; or a multivitamin (Centrum Silver) or placebo.

Conclusion

Supplementation with a multivitamin in a healthy group of older males appears to have no benefit. If multivitamins have any effect on cognition, then it was too small to be detectable.

VITAMIN E RAISES PROSTATE CANCER RISK: THE SELECT TRIAL 2008

The SELECT trial (the Selenium and Vitamin E Cancer Prevention Trial) was designed to determine the long range effect of selenium and vitamin E supplements on prostate cancer. Previous studies had hinted that both of these substances might offer protection against prostate cancer.

17 percent increase in the risk of developing prostate cancer in men who took 400 units of vitamin E daily, and no protection against developing prostate cancer from selenium.

HARMFUL EFFECTS

- Excess amount of Vitamin A consumed by pregnant women may cause birth defects. In others causes painful hyperostosis, hypercalcemia, increased ICT, headaches, occ. progressing to cirrhosis.
- Excessive amount of Niacin may cause liver damage.
- Excess Vitamin C – Gastric irritation, flatulence, diarrhoea. Even oxalate kidney stones.
- Excess Vitamin K – reduce ability of blood thinning drug to prevent blood from clotting.
- Excess Vitamin E – Increase in all- cause mortality with high doses($>$ 400IU/day), also increase Vitamin K requirement.
- Excess iron – cause nausea, vomiting and damage liver and other organs.
- Ingesting too much zinc interferes with copper and iron absorption.
- Economical burden increased.
- Pill burden increased.

Advice

- Spend money on fruits, vegetables, nuts, beans, low fat dairy.
 - Exercising would probably be a better option.
 - Check with your doctor/ health care provider before taking unnecessary medications.
 - Do not take self prescribed remedy.
 - Follow dosage limits else overdoses can be deadly.
- Whole foods are more effective than supplements in meeting nutrient needs:
- Tomato consumption has a greater effect on human

prostrate tissue than an equivalent amount of lycopene.

- Whole pomegranates and broccoli had greater antiproliferative and in vitro chemical effects than did some of their individual constituents.
- Free radicals were reduced by consumption of brassica vegetables, independent of micronutrient mix.

CONCLUSION

Vitamins / minerals do have role when food availability, intake is restricted, in a pathological condition causing nutrient deficiency like celiac disease, malabsorption, drugs and pregnant female but to be consumed in RDA amounts. We all should remember that these cannot replace food. Supplementation of a vitamins/minerals confers health benefits Only if a person is deficient in that nutrient.

Before making decision to take a supplement, it is important to consult a health care provider.

Reliable information to conclude that multivitamins offer no meaningful health benefits to the generally healthy consumer. It's time we bring an end to the era of indiscriminate multivitamin use.

There is a urgent need to enforce strict laws to prevent misuse of supplements for concern of public health.

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