

Low Oxalate Diet : Nutritional And Physiological Aspect



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Abstract

Oxalate is a common component of many foods of plant origin, including nuts, fruits, vegetables, grains, and legumes, and is typically present as a salt of oxalic acid. In food, oxalic acid is typically found as either sodium or potassium oxalate, which are water soluble, or calcium oxalate, which is insoluble. The highest levels of oxalate are found in chocolate, nuts, beans (including soybeans), rhubarb, spinach, beets, and black tea. Calcium-oxalate are the most common form of stones. Higher dietary intake leads to hyperoxaluria. The term oxalate bioavailability has often been used to refer to that portion of food-derived oxalate that is absorbed from the GIT. Oxalate bioavailability is likely dependent on a number of factors, including absorptive properties of the intestines, gut transit time, presence of divalent cations such as calcium and magnesium that can bind oxalate within the GIT, and presence of oxalate-degrading bacteria. Since vitamin C can convert to oxalate, the use of vitamin C supplements may increase oxaluria and be associated with an increased risk of stone formation; therefore, the dose of these supplements should be limited to less than 1000 mg/d.

Keywords: Oxalate, High Oxalate Diet.

Introduction

Oxalic acid and its salts occur as end products of metabolism in a number of plant tissues. When these plants are eaten they may have an adverse effect because oxalates bind calcium and other minerals. While oxalic acid is a normal end product of mammalian metabolism, the consumption of additional oxalic acid may cause stone formation in the urinary tract when the acid is excreted in the urine. Soaking and cooking of foodstuffs high in oxalate will reduce the oxalate content by leaching (Noonan and Savage 1999). Eric N. Taylor and Gary C. Curhan (2007) has opined in his study that Mean oxalate intakes were higher 214 mg/d in men, than (183 mg/d) in women with tea appearing to contribute the greatest proportion of oxalate in these diets; rhubarb, spinach and beet are other common high oxalate-content foods. Vegetarians who consume greater amounts of vegetables will have a higher intake of oxalates, which may reduce calcium availability. This may be an increased risk factor for women, who require greater amounts of calcium in the diet. In humans, diets low in calcium and high in oxalates are not recommended but the occasional consumption of high oxalate foods as part of a nutritious diet does not pose any particular problem. A low oxalate diet is usually defined as less than 2 mg oxalate per serving. However, dietary oxalate restrictions will vary depending on the underlying condition causing high oxalate levels.

Aim of the Study

The objective of this review paper is to study the nutritional and physiological aspects of low oxalate diet.

Sources of Oxalate

Oxalates are found in a wide variety of foods. Foods that come from animals usually have little or no oxalate. The stems or stalks of plants, such as amaranth, rhubarb, spinach and beet, contain significantly lower levels of oxalates than do the leaves. Oxalic acid concentration tends to be higher in plants than in meats, which may be considered oxalate-free when planning low oxalate diet.

High Oxalate Rich Foods: (50-520 mg per serving)



Chocolate and Coffee Powder



Raspberries



Sweet potato & Yam



Black tea



Nuts and seeds



Tofu and soya product



Parsley



Beet root



Rhubarb



Spinach



Wheat Bran



Swiss chard

| Moderate Oxalate (2-10 mg per serving) | Low Oxalate (0-2 mg per serving) |
|---|--|
| Liver Cabbage Carrots Onions Tomato Apple Green tea Banana Cherries Orange Papaya Pineapple Black pepper Broccoli Lettuce | Skimmed milk Cheese Eggs Butter and margarine Vegetable oils Rice & Corn Cauliflower Cabbage Cucumber Turnip Radishes Water Chestnut Sugar Avocado Grapefruits Melons Oatmeals |

High Oxalate Intake Risk

Diet having higher oxalate content has a key role in determining urinary chemistry and can influence the stone formation. Most kidney stones consist of calcium oxalate, and higher oxalate intake increases urinary oxalate excretion and the risk for calcium oxalate nephrolithiasis. The nutritional risk factors include an inadequate intake of fluids or excessive intake of foods rich in oxalate, sodium and calcium. Diet influence urinary constituents and pH, which may affect stone nucleation and growth (P.S.Viayabharathi & M. Amirthaveni 2008). Calcium oxalate is the major component of about 75% of all urinary stones. However, the relation between dietary oxalate and stone risk is unclear. The nutritional risk

factors include an inadequate intake of fluids or excessive intake of foods rich in oxalate, sodium and calcium.

The prevalence of calculi ranges from 4 to 20 percent (Hussain et al 1996). Curhan et al (1997) demonstrated that men have higher oxalate concentrations than in women. Stone is formed usually due to deposition of calcium, phosphates and oxalates which are a major health hazards.

Effect of Oxalate on Absorption of Other Minerals

Calcium combines with oxalate to form calcium oxalate in the intestinal lumen, making the calcium unavailable for absorption. The absorption of oxalates from individual foods varies depending on their dietary conditions and source; in general the

absorption is relatively limited. It has been estimated that 2–5% of administered oxalate is absorbed in humans. Only some of the minerals present in a food will be absorbed in the gastrointestinal tract due to the presence of dietary fibre, phytates and oxalates. High oxalate foods have been known to exert a negative effect on calcium and iron absorption. Calcium absorption from spinach, a high oxalate and high calcium food, was compared with calcium absorption from milk, a high calcium food, and showed that the calcium from spinach is not readily available, probably due to the high content of oxalates. The adverse effect of oxalates is greater if the oxalate:calcium ratio exceeds 9:4. The adverse effects of oxalates must be considered in terms of the oxalate:calcium ratio in a food. This ratio varies widely and can be classified into three groups: (i) plants with a oxalate to calcium ratio greater than two (e.g. spinach, rhubarb, beet leaves and roots, sorrel and cocoa); (ii) plants with a ratio of approximately one (e.g. potatoes, amaranth, gooseberries and currants); and (iii) plants with a ratio of less than one (e.g. lettuce, cabbage, cauliflower, green beans (Noonan and Savage 1999).

Effect of Processing on Oxalate

Vegetables, especially leafy vegetables are an important source of vitamins, minerals, fibre, and some essential amino acids. Foods high in oxalates should be consumed in moderation to ensure optimum intake of minerals from the diet. Although some foods are reported to be high in calcium and other essential minerals, the amount available may be limited due to the presence of oxalates. High oxalate foods should be cooked to reduce the oxalate content. Soaking raw foods will also reduce the oxalate content but other useful nutrients such as vitamin C and iron may also be lost at the same time. If high oxalate foods were to be consumed in conjunction with a low calcium diet. Different cooking methods (blanching, pressure cooking, open pan cooking, drying, boiling and sprouting) have varied effects in reducing the levels of oxalate. However, blanching and sprouting were found to be the best methods in order to reduce the contents of anti-nutritional factors. The reduction of anti-nutritional factors by cooking is

expected to enhance the nutritional value of these green leafy vegetables.

Conclusion

People having high amount of oxalate in their diet are at possible risk of stone formation due to hyperoxaluria, and mineral deficiencies if sufficient minerals are not consumed. Women tend to be more susceptible than men to calcium and iron deficiencies. Therefore, women should eat meats and meat product, which are low in oxalate, rather than vegetables, which can be high in oxalates, to satisfy their iron intake. The risk of stone formation is three times greater in males and thus, they should avoid eating excess amounts of high oxalate foods. A low-oxalate diet is often prescribed for people who have increased levels of oxalic acid in their urine or who have a history of forming kidney stones. People with a predisposition to stones are also encouraged to drink plenty of fluids (3 to 4 liters per day). Sufferers of hyperoxaluria and kidney stones are also advised to restrict their diet to low-oxalate foods because although urinary oxalate arises predominantly from endogenous sources, it can be influenced by dietary intake.

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