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Nutritional Significance of Essential Minerals in Selected Green Leafy Vegetables of Chhattisgarh: A Comparative Study

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Abstract

The green leafy vegetables form an integral part of the traditional Indian diet and provide many essential nutrients necessary for normal physiological functions. Of these nutrients, minerals are of high nutritional value including iron, calcium, magnesium, zinc, potassium, phosphorus, manganese and copper. Chhattisgarh has ample biological and agricultural diversity and several types of cultivated vegetables as well as locally grown vegetables of leaves are being found in various parts of the State. In the present study a comparative review of the nutritional significance of essential minerals present in selected green leafy vegetables of Chhattisgarh has been done. The study concentrates on the most popular leafy vegetables like spinach, amaranth, radish leaves, moringa leaves and other vegetables which are available locally. Secondary nutritional information and published literature is reviewed with special interest in the mineral composition, dietary importance, nutritional availability and potential contribution to mineral requirements. The study suggests that the contribution of minerals for leafy vegetables to the diet can play a significant role in terms of calcium, iron, magnesium and potassium. The concentration of the minerals however, can be widely variable depending on plant species, soil type, geographical conditions, agricultural practices, maturity stage and post harvest handling. Thus, mineral evaluation in a nutrition context should be taken into account. The study also emphasizes the need for proper food preparation, food-composition data and food-diversity. The result indicated that systematic documentation and lab evaluation of locally consumed vegetables could help in nutrition planning and sustainable use of plant resources of Chhattisgarh.

Keywords: *Green leafy vegetables, minerals, iron, calcium, magnesium, zinc, Chhattisgarh, nutrition, food composition and dietary health.*

Introduction

Vitamins, minerals, dietary fibre and various bioactive compounds are important vitamins that vegetables provide. Importantly, green leafy vegetables can be used to deliver several micronutrients in a food group that has a relatively low energy density. This is relevant to the nutritional adequacy and dietary diversity of their regular inclusion in the diet. The minerals, calcium, iron, magnesium, zinc, potassium, phosphorus, manganese and copper, have different physiological roles in the human body. Calcium has a role in the structure of bones and a role in some other cellular functions, iron is a part of oxygen transportation and other functions. Magnesium is involved in a number of enzymatic reactions and zinc in several physiological and enzymatic functions. Indian Council of Medical Research – National Institute of Nutrition (ICMR – NIN) has compiled Indian Food Composition Tables (ICMR – NIN IFCT), which contain information on the nutrient composition of some of the important foods in the Indian diet. Hundreds of foods are included in the database as well as a variety of nutrient and mineral parameters.

The state of Chhattisgarh has a wide spread agro-climatic variability and high reliance of a large section of population on locally available plant food. The consumption of green leafy vegetables is a part of the traditional diet in certain regions. The nutritional evaluation can thus be relevant not only from a scientific point of view, but also from the food security and dietary diversity point of view. In this study, the essential trace elements viz. Fe, Cu and Zn in some selected leafy vegetables procured from the Dharmjaigarh vegetable market of Chhattisgarh have been studied. These elements were measured in the plants and the researchers highlighted the importance of leafy vegetables as a source of essential trace elements. The present paper therefore reviews the nutritional importance of essential minerals of selected green leafy vegetables in Chhattisgarh in particular.

Rationale of the Study

Many populations still suffer from micronutrient deficiencies. One way that naturally occurring food sources can help to increase nutrient intake is dietary diversification. The advantages of locally available leafy vegetables are that they are relatively accessible and familiar to local culture. But simply because a vegetable looks good or has a good reputation does not mean that it is the right choice for someone's nutritional needs. The mineral composition will differ amongst the species and can be affected by environmental and agricultural situations. The recent study at Ambagarh Chowki, Chhattisgarh, is an example. Although the exact levels of these elements were similar for the majority of the species, there was significant variation in the accumulation of the elements between plants of the different species in this multi-element analysis. The elements were analyzed in the study and included calcium, iron, magnesium, manganese, potassium, copper and zinc. Hence the mineral composition must be compared with other vegetables to identify the nutritionally important vegetables and to understand their contribution to human diet.

The objectives of the study are to develop the following:

The main aims of the study are:

1. To study the nutritional role of important minerals in different leafy vegetables.
2. To make a comparison of the mineral content of the vegetables which are commonly consumed and are leafy vegetables.
3. To talk about the role iron, calcium, magnesium, zinc and potassium play in the diet.
4. To study the factors that affect the mineral content of vegetables.
5. To examine the possible role for leafy vegetables in mineral nutrition needs.
6. To create awareness about the nutritional value of locally available vegetables of Chhattisgarh.
7. To point out what specific areas should be investigated further in the laboratory.

Research Methodology

This study is descriptive and comparative research that is based on secondary data.

The scientific publications, the Indian food-composition resources, the nutritional guidelines and the relevant literature concerning the mineral composition of vegetables were reviewed. ICMR-NIN Indian Food Composition Tables were taken as an important reference framework as they give standard nutrient information on Indian foods.

The main focus of the study is:

- Iron (Fe)
- Calcium (Ca)
- Magnesium (Mg)
- Zinc (Zn)
- Potassium (K)
- Phosphorus (P)
- Manganese (Mn)
- Copper (Cu)

Analysis is not experimental, instead interpretative. This paper does not claim any original laboratory measurements. In this regard, the discussion makes a distinction between published results and general interpretation of nutrition.

Essential Minerals are of great importance.

1 Iron

Iron is an important mineral that carries oxygen and helps carry out certain metabolic functions. Iron-rich vegetables can help to increase iron intake in the diet, especially when they're mixed with other food. The nutritional value of plant iron is not only related to its concentration, but is also influenced by dietary constituents which affect iron absorption. Thus, the iron content of vegetables should be viewed in the context of the overall dietary pattern, rather than as a stand-alone nutritional intervention.

2 Calcium

Calcium is known for its bone and tooth health benefits. It also plays a role in muscle contraction, cellular signaling and other physiological processes. Some green leafy vegetables provide a source of calcium. The actual nutritive contribution, however, depends on the quantity consumed, mineral concentration of the vegetable and factors which affect the mineral bioavailability.

3 Magnesium

Magnesium is involved in a number of biochemical reactions, and plays a role in normal cellular and metabolic functions. One of the plant foods to provide magnesium to the diet is green leafy vegetables. A phytochemical analysis of the food composition of different plant species may be useful to pinpoint those plants that have a higher potential for dietary contribution of magnesium.

4 Zinc

Zinc plays important roles in enzyme activity, cellular processes and normal physiological functioning. Zinc can also be obtained in vegetables, in addition to other foods.

Zinc is one of the essential minerals required in the Indian diet as mentioned in the ICMR-NIN nutritional framework. The recommended intake depends on physiological condition and sex and age of the person.

5 Potassium

Potassium is a mineral that is important in the diet and is related to fluid balance, cellular activity and neuromuscular activity. Vegetables are a good source of potassium. Potassium is widespread within the plant foods and a diet rich in a diversity of vegetables can enhance mineral intakes and dietary diversity.

It is considered a selected Green Leafy Vegetable.

The following leafy vegetables are special in comparison:

1 Spinach

Spinach is one of the most popular leafy vegetables that is rich in a number of micro-nutrients. In the database of food composition data for India, spinach is one of the food items analyzed and details of its mineral constituents are available. It is a valuable reference vegetable for mineral comparisons because of its nutritional value.

2 Amaranth

Leaves of Amaranthus are used in various parts of India and are one of the important categories of leafy vegetables. They may have different mineral composition depending on species, soil and cultivation.

3 Radish Leaves

Although there are a number of nutrients in the leaves of radish, they are rarely used. The data on food compositions from India show mineral composition of radish leaves, which reveal minerals contributed by vegetable leaves other than the part commonly eaten.

4 Moringa Leaves

Moringa leaves are of nutritional importance and are eaten in different Indian cuisines. Chhattisgarh has specifically studied the accumulation of minerals in Moringa oleifera leaves in the study. The study found Moringa leaves to be comparatively significant in terms of the concentrations of calcium and other elements.

Other Leafy Vegetables, Locally Consumed, 6.5

There are also some of the old and local collected leafy vegetables in Chhattisgarh. These plants should be studied more in detail due to their high nutritional value which may not be sufficiently reflected in national food databases.

Comparative Mineral Significance

Selected leafy vegetables are important nutrient sources in a multi-mineral context.

Mineral	Major Nutritional Significance	Relevance of Leafy Vegetables
Iron	Oxygen transport and metabolism	Can contribute dietary iron
Calcium	Bone and cellular functions	Important plant-based mineral source
Magnesium	Enzymatic and metabolic functions	Commonly present in leafy plants
Zinc	Enzyme and cellular functions	Contributes to dietary mineral diversity
Potassium	Fluid and cellular balance	Frequently supplied by vegetables
Phosphorus	Cellular and skeletal functions	Present in plant foods
Manganese	Enzymatic functions	Found in varying amounts
Copper	Enzyme and metabolic functions	Present as a trace mineral

Different species of vegetables contain different amounts of these minerals. In a study of seven leafy vegetables, conducted in Chhattisgarh, there were some differences among the species in the amount of elements they accumulated, with some vegetables containing more of certain elements and others more of others. This variation reinforces the value of eating a variety of vegetables and foods, rather than just one.

10. Management of Seeds and Plants.11. Equipment and Tools.

Plants' mineral concentration is affected by a number of environmental factors. These include:

- Soil mineral composition
- Soil pH
- Moisture availability
- Fertilizer application
- Irrigation practices
- Plant species
- Stage of maturity
- Climatic conditions
- Agricultural practices

Consequently, the mineral concentration of a particular vegetable grown in a specific geographic area should not be taken as a guarantee that it will be the same for the same species grown in a different geographic area. The concern is specially applicable on Chhattisgarh as environmental and agricultural conditions are different in various parts of the state. The Ambagarh Chowki study highlights the significance of using geographical context. It revealed significant inter-vegetable species variations in the elemental uptake and proposed that these differences may be due to geology as well as agriculture.

10. Nutritional Value in view of the Indian Nutrient Requirements.

The nutrient content of a vegetable can only be understood in relation to the recommended nutrient intakes. ICMR-NIN has recommended the dietaries allowances for various minerals, such as calcium, magnesium, iron and zinc. For instance, the recommendations for India for 2020 suggest calcium requirement as 1000mg/day for adult men and women in the general adult category, whereas iron requirement is different for men and women as well as other

factors. This shows that a vegetable is not just an "immunity booster" because it contains merely one mineral. Instead, it should be considered in terms of its nutritional value:

1. Mineral concentration.
2. Amount normally consumed.
3. Frequency of consumption.
4. Mineral bioavailability.
5. Overall dietary composition.
6. Individual nutritional requirements.

So, leafy vegetables are considered as foods in a balanced diet that contribute nutrients.

10. Mineral Diversity and Dietary Health

One benefit of eating various vegetables is that you can get several nutrients from their various foods. No one vegetable does necessarily contain all minerals in optimal amounts. For instance, one vegetable can contain a higher proportion of calcium, and another a higher proportion of iron, magnesium or potassium. Thus, several vegetables can be combined to enhance dietary diversity. Dietary diversity is especially relevant in communities where the vegetables consumed locally are an important part of the diet. Traditional leafy vegetables can offer nutritional benefits, as well as help preserve agricultural biodiversity and local food culture.

11. Food Safety Considerations

Mineral enrichment should not be considered independently of food safety.

All plants take up elements from their surroundings, some of which are essential while others can be toxic. The study done in Ambagarh Chowki revealed that there was significant variation in the accumulation of 52 elements in seven species of leafy vegetables. The researchers also found examples of some components being above reported maximum levels, which highlights the importance of taking into account both nutrition and contamination.

Otherwise future research on vegetables of Chhattisgarh should consider the following:

- Essential minerals
- Potentially toxic elements
- Soil characteristics
- Irrigation-water quality
- Agricultural inputs
- Food preparation practices

Such integrated approach would enable a more scientific and comprehensive evaluation of the safety and nutritional value of vegetables.

Research Gaps

Food-composition databases are valuable but there are a number of gaps in research. First, nationally averaged food-composition data may not completely represent regional variation. In addition to the food samples collected from various geographical areas in the IFCT database, more research needs to be done into the food composition of these areas to better understand the information available in the local context. Secondly, some of the traditional vegetables eaten in Chhattisgarh might not have a detailed mineral profile. Third, the level of mineral concentration in raw vegetables may not be the same as that of cooked vegetables. Fourth, there is a need for more research on bioavailability of minerals instead of just concentrations. Last, but not least, there are studies that integrate nutritional analysis and environmental contamination assessment that would give more robust evidence for dietary recommendations.

The possibilities of the study are explored in the next chapter.

Future investigations can be based on laboratory studies of:

1 Sample Collection

The samples of vegetables can be taken from various blocks of the districts in the Chhattisgarh state to represent the geographical diversity.

2 Laboratory Analysis

Steps to determine minerals can include the use of Atomic Absorption Spectroscopy (AAS), ICP-OES or ICP-MS.

3 Soil-Vegetable Relationship

Vegetables can be analyzed in conjunction with soil to establish the relationships between soil composition and mineral accumulation in plants.

4 Seasonal Comparison

Analysis of the vegetable during various seasons can be used to find out seasonal variation in the levels of minerals.

13.5 Cooking Effects

Both raw and cooked samples can be compared to see if minerals are retained.

13.6 Bioavailability Assessment

Distinguishing the total mineral concentration from the fraction which is available for physiological absorption should be taken into account in future research.

Discussion

Comparative review shows that green leafy vegetables are nutritionally relevant as they can provide several important minerals in a diversity of a diet.

Ideas of nutritional superiority must be used with caution however. Relying on a vegetable that has a relatively high content of one mineral does not make it automatically superior. The nutritional value is determined by several factors, such as: the level of minerals, amount of ingestion, mineral bioavailability, cooking method as well as the

overall diet composition. The findings from the Chhattisgarh experiment indicates that there is variability in mineral accumulation between different species of vegetables. The study conducted at Ambagarh Chowki showed different elemental pattern in various leafy vegetables, thereby emphasizing the need for species specific study. In a similar study in the Dharmjaigarh market, the levels of iron, copper and zinc were detected in some of the leafy vegetables and the vegetables were reported as rich sources of these essential trace elements. The results show the leafy vegetables of Chhattisgarh are a good region for nutritional and food-science studies.

Major Findings

The important results of the study are:

Green leafy vegetables are a good source of some key minerals.

Different species of vegetable plants have different mineral content.

The nutritional evaluation is of special interest for three (3) minerals: Iron, Calcium, Magnesium, Zinc and Potassium.

Mineral accumulation may be affected by geographical and agricultural factors.

Further comparative evaluation of the use of moringa, spinach, amaranth and other leafy vegetables is recommended.

There is a need for scientific documentation of locally available traditional vegetables.

National food-composition data are important for reference purposes but do not necessarily reflect local variation.

The nutritional effectiveness of minerals is not based simply on their concentration.

The dietary consumption patterns and bioavailability should be taken into account.

Nutritional analysis should be done in conjunction with food safety assessment.

Chhattisgarh is an important region for the mineral profiling of vegetables.

Future lab work may help in the evidence-based planning of nutrition at the regional level.

Recommendations

The following recommendations are made from the review:

In the future, system mineral profiling of locally consumed vegetables from Chhattisgarh should be done.

Samples should be taken from several different geographical areas.

The mineral composition of soil and vegutables should be investigated simultaneously.

All essential and potentially toxic elements should be analysed.

The raw and cooked samples of vegetables should be compared.

Future food-composition data bases should contain traditional leafy vegetables.

Nutritional education should focus on food diversity and not the consumption of "superfoods" alone.

Laboratory findings must be interpreted in view of the requirements of the ICMR – NIN diet.

Mineral bioavailability should be studied further.

Seasonal and geographical variation should be studied over the long-term.

Conclusion

Greens, leafy vegetables, are an important part of a healthy and well balanced diet. Their value is not limited to any single nutrient as they can contain several nutrients such as minerals, vitamins, fibre and others. The present comparative review shows that the leafy vegetables contain significant amount of essential minerals like iron, calcium, magnesium, zinc and potassium, which are important in terms of nutrition. The concentrations of minerals vary, however, between plant species and can be affected by soil, geographical location, agricultural methods, season and post harvest handling. It has been shown from the evidence of Chhattisgarh that locally available leafy vegetables can be a source of essential trace elements in measurable amount and elemental profile of different vegetables varies significantly. Hence, future studies should go beyond the basic assertion of "mineral-rich" or "immunity-boosting" vegetables and take a holistic approach that takes into account mineral concentration, bioavailability, dietary intake, geographical variation and food safety. The scientific evaluation of traditional and cultivated leafy vegetables in a systematic manner can lead to better food composition databases, awareness and sustainable utilization of local plant resources in Chhattisgarh.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of thesis paper.

References

1. ICMR-National Institute of Nutrition. (2017). Indian Food Composition Tables (I.F.C.T.) Indian Council of Medical Research, National Institute of Nutrition.
2. ICMR-National Institute of Nutrition. (2020). Nutrient Requirements for Indians, Recommended Dietary Allowances. Hyderabad: ICMR-NIN.
3. ICMR-National Institute of Nutrition. (2024). Food pyramid of India. NIN, Hyderabad.

4. Hait, M., Patel, A., & Rajput, C. S. (2017). Heavy metal concentration of selected vegetables (leafy vegetables) collected from the local market of Dharmjaigarh, Chhattisgarh, India. Asian Journal of Research in Chemistry, 10(3), 354–358.
5. Recently study was conducted on multi element contamination and health risk assessment of green leafy vegetables in Ambagarh Chowki, Chhattisgarh, India. PubMed, 2024.
6. ICMR-NIN. Indian Food Composition Data Base and Nutritional Composition Resources. The National Institute of Nutrition (NIN).