

# Analysis of Macronutrients (Calcium & Magnesium) and Trace Elements (Iron & Zinc) in Common Edible Indian Foods

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**Abstract**— Commonly available Indian foods containing rich sources of macronutrients (Ca and Mg) and trace elements (Fe and Zn). Dietary intake of these foods will reduce the diseases like prematurity, Rickets, Renal disease, Anemia, Hyperkalemia, Anuria, Tissue damage etc.. The aim of the present work is to determine the amount and percentage of macronutrients Calcium, Magnesium and trace elements Iron, Zinc in various food samples. The results showed that cashew nut, ground nut and spinach contains maximum amount of Calcium, Magnesium, Iron and Zinc in the range of 0.031 gL<sup>-1</sup>, 0.091 gL<sup>-1</sup>, 0.2458 gL<sup>-1</sup> and 0.0408 gL<sup>-1</sup> respectively, it measured from more than fifteen different types of juices extracted from common edible locally available foods in and around Tholayavattam area Kanyakumari district, Tamilnadu, India.

**Keywords**— *Macronutrients, trace elements, fruits, vegetables, nuts*

## I. INTRODUCTION

The presence of about 40 different elements has been established in living bodies. The most abundant elements in biological systems are C, H, O and N. These elements are involved to produce the biomolecules like water, carbohydrate, protein and fat. The elements Na, K, Ca, Mg, P, S and Cl are nutritionally important principal elements. The deficiency of these can prove fatal. So they are called Macro elements. The next most abundant elements are Mo, Mn, Fe, Co, Cu, Zn, F and I. These eight elements are present at trace quantities. So they are called essential trace elements. The elements Li, Si, V, Cr, Se, Br, Sn and W are required at ultra trace concentrations [1]. Plant food sources of Iron include dried fruit, peas, asparagus, leafy greens, strawberries and nuts. On the other hand, with few exceptions, fruits and leafy vegetables are believed to occupy a modest place as a source of trace elements due to their high water content. Consumers look for variety in their diets and are aware of the health benefits of fresh fruits and vegetables. Of special

interest are food sources rich in Calcium (Ca), Magnesium (Mg) and Potassium (K). Most of these nutrient requirements can be met by increasing the consumption of fruits and vegetables to 5–13 servings/day. In addition to meeting nutrient intake levels, a greater consumption of fruits and vegetables is associated with reduced risk of cardiovascular disease, stroke, and cancers of the mouth, pharynx, esophagus, lungs, stomach, and colon [2,3].

Calcium is an essential mineral required for diverse physiological and biochemical functions in the human body. Data from surveys by the Thai Ministry of Public Health revealed that Thai people had insufficient calcium intake to meet the national RDI during most of their lives. The last survey in 1994 showed the average calcium intake of Thai people to be 344 mg/day, which is about 43% of Thai Recommended Daily Intake (Thai RDI, 800 mg calcium per day) [4]. Nour et al. [5] have determined from analyzed Apple samples, magnesium concentrations in the range 5.02– 11.83 mg/100g. Magnesium is an active component of several enzyme systems in which thymine pyrophosphate is a co-factor. Oxidative phosphorylation is greatly reduced in the absence of magnesium. Magnesium is also an essential activator for the phosphate-transferring enzymes myokinase, diphosphopyridinenucleotide kinase, and creatine kinase. It also activates pyruvic acid carboxylase, pyruvic acid oxidase, and the condensing enzyme for the reactions in the citric acid cycle. It is also a constituent of bones, teeth, enzyme co-factor, (kinases, etc).

The health status of the digestive system and the kidneys significantly influence magnesium status. Magnesium is absorbed in the intestines and then transported through the blood to cells and tissues. Approximately one-third to one-half of dietary magnesium is absorbed into the body. The element zinc is necessary for numerous enzymatic reactions and the absorption of diverse vitamins, mainly vitamins of the B complex. It is very important to maintain

healthy skin, self-immunity and good functioning of the prostate gland. Iron is involved in the synthesis and packaging of neurotransmitters, their uptake and degradation into other iron-containing proteins which may directly or indirectly alter brain function [6]. Zinc is also necessary for the protection of the sexual hormones and for natural growth. In the same way as magnesium, zinc participates in about 200 metallo enzymatic reactions [7]. The aim of the present study was to determine the components (Ca, Mg, Fe and Zn) from fruits, foods, nuts and vegetable juices.

## II. MATERIALS AND METHODS

The experimental food samples Cashew nut, Ground nut, Jaggery, Potato, Raisin, Bitter guard, Coconut, Ragi, Beans, Spinach, Mustard, Beet root, Milk and Wheat were collected. All the reagents used were chemically pure and analytical grade. Reagent grade organic solvents were purified and dried by recommended procedures [8] and degassed before use. Zinc sulphate ( $ZnSO_4$ ), Mohr's salt (FAS), EDTA disodium salt, Eriochrome black - T, Potassium permanganate ( $KMnO_4$ ), Aqueous ammonia, Ammonium chloride ( $NH_4Cl$ ), Sulphuric acid, Hydrochloric acid were purchased from Sd fine chemicals, India.

### Sample preparation:

Transfer 10 g of specific food sample in a mortar and pestle and ground well. Extract the sample in deionized water and made up to 100 ml.

### Estimation of Calcium :

About 20 ml of the food sample solution was neutralized with aqueous ammonia. 2 ml of buffer solution ( $NH_4Cl-NH_4OH$ ), a drop of Eriochrome black -T indicator were added and titrated against EDTA solution until the colour change from wine red to blue. From the titre value the strength as well as the amount of calcium present in the whole of the sample solution was calculated.

### Estimation of Magnesium:

Magnesium was estimated by complexometric titration using EDTA as complexing agent as Calcium estimation. From the titre value, the strength and amount of Magnesium present in the whole of the food sample was calculated [9].

### Estimation of Iron :

Permanganometric titration was used to estimate Iron in food samples. From the titre value the strength as well as the amount of Iron present in the whole of the food sample was calculated.

### Estimation of Zinc:

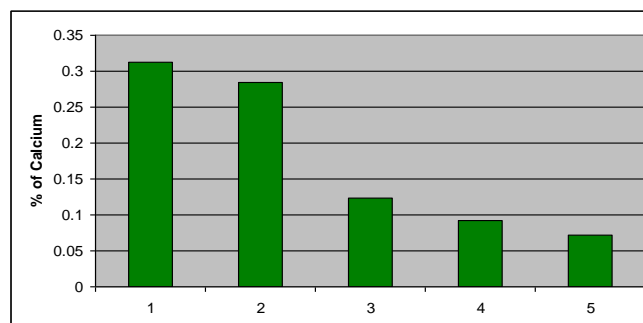
Using complexometric titration Zinc was estimated in food samples. From the endpoint the strength and amount of Zinc present in the whole of the food sample was calculated [10].

## III. RESULTS AND DISCUSSION

Twenty different common edible Indian foods were collected for the present study. The macronutrients (Calcium and Magnesium) and trace elements (Iron and Zinc) were estimated by using complexometric and permanganometric titrations. Table 1 shows the amount and percentage of calcium present in five different common foods, calcium makes the major element of bones and teeth. It also participates in muscle contractions, conduction of nerve impulses and cell membrane permeability, where the maximum amount  $0.0312 \text{ g L}^{-1}$  of calcium present in cashew nut and minimum amount  $0.0072 \text{ gL}^{-1}$  was observed in wheat. Shortage of calcium in children is manifested by rickets and inadequate growth. Table 2 shows the amount and percentage of Magnesium present in five different foods samples. Among them ground nut contains maximum  $0.0196 \text{ gL}^{-1}$  (0.0.196%) and Beans contains minimum amount  $0.0040 \text{ gL}^{-1}$  and 0.040% percentage of Magnesium. Magnesium is an important mineral mainly found in bones along with Calcium. Table 3 shows the amount and percentage of Iron present in five different common edible foods, where the maximum amount  $0.2458 \text{ gL}^{-1}$  and 2.458% of Iron present in spinach and minimum amount  $0.0847 \text{ gL}^{-1}$  and 0.847% of Iron present in Raisin. Iron deficiency is one of the most important prevalent nutritional deficiencies in India. Table 4 shows the amount and percentage of Zinc present in five different foods samples, Among them spinach contains maximum amount  $0.0408 \text{ gL}^{-1}$  and percentage of Zinc 0.408% and wheat contains minimum amount  $0.0098 \text{ gL}^{-1}$  and percentage of Zinc 0.098%[11]

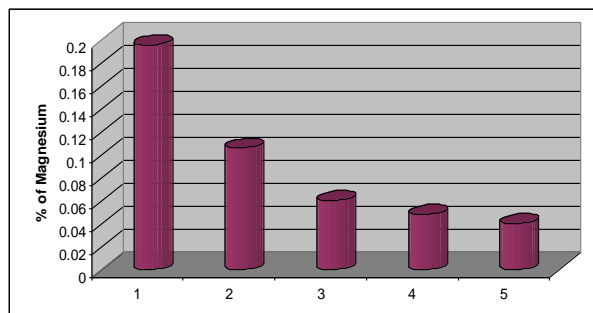
No.	Sources	Weight/ litre (g)	Percentage %
1.	Cashew nut	0.0312	0.312
2.	Jaggery	0.0284	0.284
3.	Ragi	0.0124	0.124
4.	Raisin	0.0092	0.092
5.	Wheat	0.0072	0.072

Table 1: The amount and percentage of calcium present in five different common edible foods.



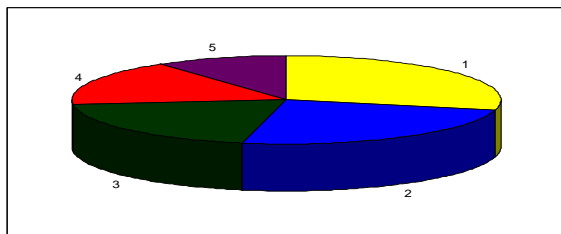
No.	Sources	Weight/litre (g)	Percentage %
1.	Ground nut	0.0196	0.196
2.	Potato	0.0106	0.106
3.	Bitter guard	0.0060	0.060
4.	Coconut	0.0048	0.048
5.	Beans	0.0040	0.040

Table 2: The amount and percentage of magnesium present in five different common foods.



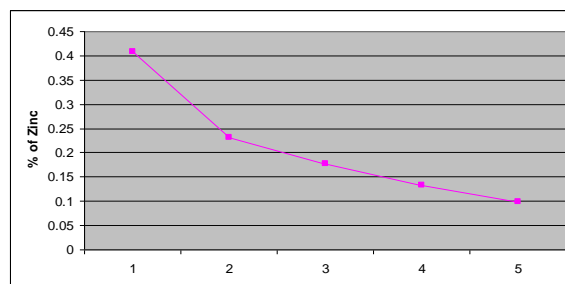
No.	Sources	Weight/ litre (g)	Percentage %
1.	Spinach	0.2458	2.458
2.	Ground nut	0.2077	2.077
3.	Beet root	0.01723	1.723
4.	Cashew nut	0.1413	1.413
5.	Raisin	0.0847	0.847

Table 3: The amount and percentage of Iron present in five different common foods.



No	Sources	Weight/litre (g)	Percentage %
1.	Spinach	0.0408	0.408
2.	Mustard	0.0231	0.231
3.	Milk	0.0176	0.176
4.	Coconut	0.0132	0.132
5.	Wheat	0.00098	0.098

Table 4: The amount and percentage of zinc present in five different common foods.



#### IV. CONCLUSIONS

The present study demonstrated the presence of Calcium, Magnesium, Iron and Zinc were estimated. From this we can concluded that cashew nut has maximum and wheat contains minimum amount of calcium. Simultaneously Groundnut contains larger and beans contains smaller amount of magnesium. spinach contains maximum amount of Iron and Zinc, and Raisin and wheat contains minimum amount of Iron and zinc respectively.

The intake of Calcium and Magnesium rich foods will reduce the common diseases like Renal failure, Hyperkalemia, Rickets, Vitamin C deficiency etc. The Iron and Zinc rich food samples will reduce the common diseases like Anuria, Tissue damage, Diabetes mellitus, kidney failure, Anemia etc.

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