



Nutritional composition of raw fresh and shade dried form of spinach leaf (*Spinach oleracea*)

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ABSTRACT

Green leafy vegetable consumption has been associated with decreased risk of persistent metabolic diseases. The present study examined the proximate and mineral composition of spinach leaves (*spinach oleracea*) belong to the family Amaranthaceae grown in Tiruchirappalli District, TamilNadu. Fresh spinach leaves were obtained from local market of Tiruchirappalli District, TamilNadu. Random selection of leaves was done by purchasing from randomly selected sellers in the market. The purchased leaves were cleaned by washing with water to remove dirt and other contaminants. The raw fresh and powder obtained from shade dried leaves of spinach were sent to the laboratory for analysis. From the results, raw fresh spinach was found to be a good source of vegetable protein (11.10%) and fiber (21.38%). Other proximate parameter studied include moisture (36.8%), Ash (6.96), Carbohydrate (20.28%) and fat (3.47%). Mineral magnesium content in raw spinach was found to be abundant (205.10mg/100g). The powder obtained from the shade dried spinach leaf contain rich source of vegetable protein (19.10%) and other parameter includes moisture(11.17%), ash(5.57%), carbohydrate(41.49%), fat (7.11%) and fiber(15.48%). The result suggests that Spinach (*spinach oleracea*) has a high potential health benefits for diabetes, cardiovascular disease, obesity and osteoporosis. The result obtained serve as a nutritional data base for local consumers, as well as for further research purposes. Combination with other foodstuffs is recommended to meet satisfactorily the nutritional needs. Spinach (*spinach oleracea*) has high potential as a leafy vegetable in the preparation of different south Indian dishes and treatment of various diseases due to its nutritional potentials.

KEYWORDS: Nutrient composition, *Spinach oleracea*

INTRODUCTION:

In nature, there are many underutilized greens of promising nutritive value, which can nourish the ever increasing human population. They have remained underutilized due to lack of awareness and popularization of technologies for utilization^[1]. Plant leaves are one of the most important sources of medicines. The medicinal plants are rich in secondary metabolites (which are potential sources of drugs) and essential oils of therapeutic importance. The important advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability^[2]. A high intake of fruit and vegetables is well known to have positive effects on human health and has been correlated to a decreased risk of most chronic diseases such as cardiovascular disease, diabetes and several forms of cancer^[3]. Spinach (*Spinach oleracea*) is an edible flowering plant in the family of Amaranthaceae. *Spinach oleracea* Linn. (SO) is an annual plant having medicinal property native to central and southwestern Asia. It is cultivated for the sake of its succulent leaves and was introduced in Europe in the 15th cen-

tury. It is the favorite food among Indians in winter season^[4]. *Spinach oleracea* is commonly known as Spinach (English), Chhurika (Sanskrit), Palak (Hindi; Gujarati; and Marathi), Palakh (Kashmiri), Palang (Bangla), Pasalai (Tamil), and Mathubucchali (Telugu)^[5]. Spinach has a high nutritional value and is extremely rich in antioxidants, especially when fresh, steamed, or quickly boiled. Spinach contains different carotenoids like lutein, β -carotene, violaxanthin and 9'-*(Z)*-neoxanthin and contains high concentration of vitamins like A, E, C, and K. and also folic acid, oxalic acid, various minerals present in the spinach^[4]. These are magnesium, manganese, calcium, phosphorus, iron, zinc, copper and potash^[6]. Apart from having nutritional value, it has been also credited with various biological activities like virus inhibitor^[7], anthelmintic^[8], and antioxidant^[9], hepatoprotective^[10] and reducing risk of breast cancer^[11]. Hence this work was undertaken to determine the proximate and mineral composition of spinach grown and the objective of the study was to identify the nutrient composition of raw and shade dried leaf powder of spinach grown in Tiruchirappalli District, TamilNadu.

MATERIAL AND METHODS:

Collection and preparation of plant material:

The spinach (*spinach oleracea*) leaves were purchased at market in Tiruchirappalli district. Random selection of leaves was done by pur-

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chasing from randomly selected sellers in the market. The leaf were identified and authenticated by Research Department of Botany, Jamal Mohamed College, and Thiruchirappali. The green leafy vegetables were sorted to remove spoilt, low quality vegetables from the bulk. They were picked and remove from the stalk, trimmed, washed and shredded. Washing was done with water to remove dirt and other contaminants and divided into two parts. One part of the leaves were rinsed thoroughly and packed in polthyene bags and send to the laboratory for analysis. The remaining parts of leaves were allowed to shade dried for a week before proximate analysis was carried out.

Proximate Analysis:

The sample was analyzed for proximate composition of Moisture, Ash, protein, fat and crude fiber content of the raw and dried form of leaves were determined using AOAC (2005) method [12]. Carbohydrate was determined using the method [13]. The mineral magnesium was determined by (AAS) using the method [14].

Statistical Analysis:

The student means were used for the analysis of the result.

RESULTS AND DISCUSSION:

Vegetables play a significant role in human nutrition, apart from the fact that the most of our recommended daily needs of minerals and vitamins are met and they also supply certain constituents in which other food materials are deficient. The wide variations in color, taste and texture of various vegetables have added an interesting touch to meals. The cultivation and consumption of green leafy vegetables cuts across different races because of their nutritional and health benefits [15]. They have been shown to reduce the risk of degenerative diseases such as cancer, diabetes and cardiovascular disease. The nutrient composition of the raw fresh and shade dried spinach leaf powder revealed the following significance. The proximate values of spinach is shown in Table-1 and fig.1

Table 1. Proximate Composition of Spinach (*Spinach Oleracea*)

Nutrients in percent	Fresh, raw leaves	Shade dried leaf powder
Moisture	36.8	11.17
Ash	6.96	5.57
Carbohydrate	20.25	41.49
Protein	11.10	19.10
Fat	3.42	7.11
Crude fiber	21.38	15.48

Percent of Moisture Content:

It is observed that water contents otherwise referred to as moisture content in both fresh raw and dried powder form of spinach leaves were substantially reduced three times after shade drying. From the result it could be inferred that the moisture content of raw fresh leaves (36.80%) was relatively higher than that of dried powder form (11.18%) of leaves. The moisture content of vegetables makes them to aid the digestion of food and facilitates bacterial action resulting into spoilage.

Percent of Ash Content:

Percent of ash content was higher in the fresh leaves of spinach (6.96%) than its shade dried leaves (5.58%) respectively (fig.2).

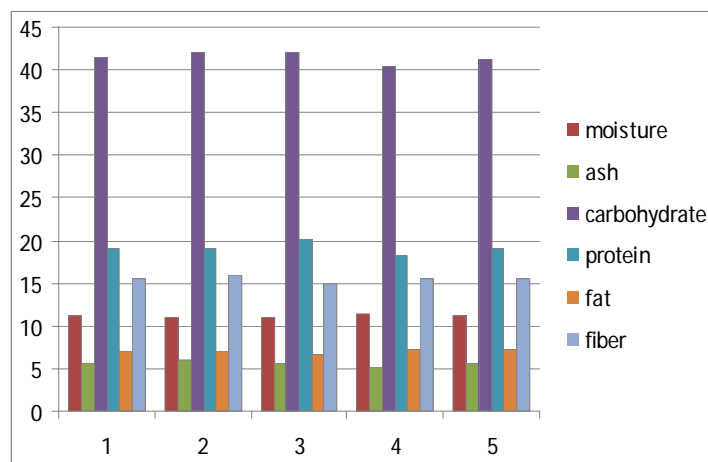


Fig2: Shows the nutrient composition of spinach leaf powder in Percent

Percent of Carbohydrate Content:

The carbohydrate content was lower in the fresh leaves of spinach than its shade dried leaf powder was shown in Table -1

Percent of Fat Content:

The fat content was lower in fresh leaves of spinach (3.47%) than its shade dried leaf powder (7.12%). Due to the general low level of crude fat in vegetable leaves and its high level of total unsaturated fatty acid, their consumption in large amounts would be beneficial to individual suffering from overweight or obesity and this would constitute a good dietary habits.

Percent of Protein Content:

Percent of protein content was lower in fresh leaves of spinach (11.10%) than its shade dried leaf powder (19.10%) respectively. The value was higher than that (2.9g/100g) recorded by the USDA nutrient data base for standard reference [16]. Its protein content makes it suitable for consumption, as a necessity for body development. The protein value of spinach observed in this study confirms the advantage as a rich source of vegetable protein over some vegetables such as raw *Amaranthus* (6.1%) and *Moringa oleifera* (4.2%) as reported [17]. The plant foods, when rightly combined with other foods can be of high biological value and adequately meet the protein needs of

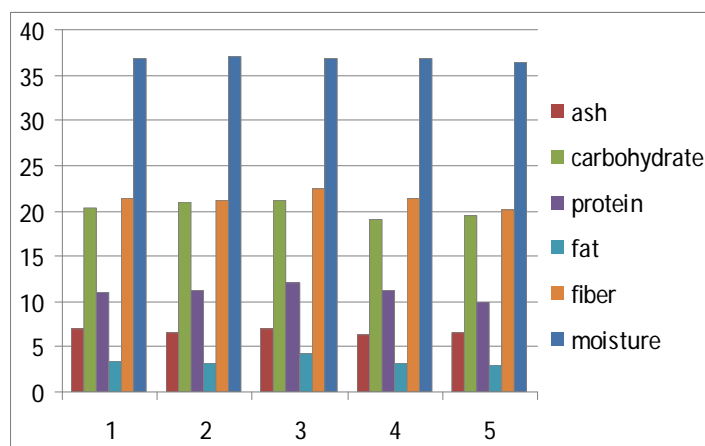


Fig1: Shows the nutrient composition of raw fresh spinach in Percent

malnourished children and adults. The crude protein in the leafy vegetable would require dietary supplementation with proteins from cereals and legumes^[18].

Percent of Crude Fiber:

The fiber content percent was found to be higher in fresh leaves of spinach (21.38%) than its shade dried leaf powder (15.49%) respectively. This value is high as compared to the fiber value of other vegetables such as kale (3.00%). Basella Alba a type of spinach variety, had an appreciable level of crude fiber^[19]. Leafy vegetables are particularly rich in dietary fiber and these fiber contents together with the low carbohydrate contents found in these spinach are good in the management of diabetes mellitus. Fiber also adds bulk to the food and prevents the intake of excess starchy food and may therefore guard against metabolic conditions such as hyper cholesterolemia and diabetes mellitus. Fiber can also help to keep blood sugar levels under control. Fiber binds to cancer causing chemicals, keeping them away from the cells lining the colon, providing yet another line of protection from colon cancer^[20]

Table 2. Mineral Composition (mg/100g) of Spinach (*Spinach oleracea*)

Nutrients	Fresh Raw Leaves	Shade dried leaf powder
Magnesium	205.10	20.70

Values are mean of triplicate determinants

Percent of Magnesium:

Mean magnesium content was found to be high in raw fresh spinach than the shade dried powder form (Table -2). Magnesium is an important component of many unprocessed foods, such as whole grains, nuts, and green leafy vegetables, and it is largely lost during the processing of some foods^[21]. The study reported that it is essential for all energy-dependent transport systems, glycolysis, oxidative energy metabolism, biosynthetic reactions, normal bone metabolism, neuromuscular activity, electrolyte balance, and cell membrane stabilization^[22].

CONCLUSION:

From the results of this study, it is clear that spinach (*spinach oleracea*), though a lesser known leafy vegetables, has enormous nutritional potentials and thus can favourably be used as a substitute for most of the commonly used vegetables. The spinach is nutritious food that provide sufficient amount of nutrients for normal body function, maintenance and reproduction. In raw fresh leaves carbohydrate and fat content was found to be lesser and it is found to be an excellent choice of leafy vegetable for people with diabetes and obesity. Spinach has been recognized as a good source of vegetable fiber both in raw fresh and powder form, which helps to reduce high cholesterol levels thus helping in prevention of atherosclerosis. It can also help in keeping blood glucose levels under control and is an excellent vegetable for people with diabetes. The protein content of spinach in raw fresh and powder confers form has the advantage as a

rich source of vegetable protein over other lesser known vegetables. It could be recommended for the children with malnutrition. Magnesium content was found to be abundant in raw spinach when compare to powder form. It is evident from the result that magnesium content in raw fresh spinach has an inverse association between magnesium intake and diabetes risk. The result obtained serve as a nutritional data base for local consumers, as well as for further research purposes. Combination with other foodstuffs is recommended satisfactorily to meet nutritional needs satisfactorily. Spinach (*spinach oleracea*) has high potential as a leafy vegetable in the preparation of different south Indian dishes and treatment of various diseases due to its nutritional potentials.

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