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Estimation of Macronutrients in Hygrophilla Auriculata and it's Comparison with the Conventional Green Leafy Vegetables

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Abstract: ***Green leafy vegetables are the best gift of mother nature in India. There are numerous varieties of green leafy vegetables which has got very considerable importance in our health. Many of them are used as culinary purpose and others are used as ayurbedic medicine. In the present studies the macronutrients contents of Hygrophilla auriculata (kulekhara leaves) were analazyed. Kulekhara leaves are widely grown, easily available in Indian market but neglected, nutritious green leafy vegetable which is not consumed due to lack of knowledge by common people. It can be investigated to improve nutritional scenario of our country. Quantitative estimation of macro-nutrients has showed that 100gm fresh kulekhara leaves contain 58.80 kcal of energy, 10.01 gm of carbohydrate,4.69 gm of protein, 1.80gm of dietary fiber, 1.93 gm of total ash, 83.37 gm of moisture and very negligible amount of fat.***

Keywords: Green leafy vergetables, Hygrophilla auriculate, Macronutrients, dietary fiber, ash etc

1. Introduction

India is a store house of enormous edible green leafy vegetables which are grown locally and these are utilized in our regular diet. Among these green leafy vegetable one of the important is Kulekhara leaves. Kulekhara leaves also known as Hygrophilla spinosa or Hygrophilla auriculata. Hygrophila spinosa T. Anders belonging to the family Acanthaceae called Talimkhana is described in ayurvedic literature as Ikshura, Ikshugandha and Kokilasha "having eyes like Kokila or the Indian Cuckoo", common in moist places – on the banks of tanks, ditches, and paddy fields. It is believed to be indigenous to India from the Himalayas to Srilanka, Myanmar, Malaysia, and Nepal. (1)

The plant contains various groups of phytoconstituents, namely, phytosterols, fatty acids, minerals, polyphenols, proanthocyanins, mucilage, alkaloids, enzymes, amino acids, carbohydrates, hydrocarbons, flavonoids, terpenoids, vitamins, and glycosides.(2)

Previously there was a myth that these leaves are beneficial to treat anaemia as consumption of the juice of these leaves can increase the haemoglobin level. Latter Gomez et al. showed in an experimental animal study that the ethanolic and aqueous extract of kulekhara leaves have a very effective heamatinic effect and that can successfully increase the total RBC count, WBC count and heamoglobin level. (3)

Some of the commonly consumed leafy vegetables are amaranth, spinach, ipomoea, bottle gourd leaf, colocasia leaves etc. The nutritive value of these conventional leafy vegetables has been reported in the book of "The Nutritive Value of Indian Food" by C. Gopalan. But no nutritional information are there for Kuelhara leaves. Mukherjee C, Datta (De) et al. showed that fresh kulekhara leaves are very rich source of vitamin –c, iron, sodium and potassium. Other nutrients like **β- carotene, riboflavin, copper and calcium** are also present in considerable amount in fresh kulekhara leaves. 100gm of fresh kulekhara leaves contain about 56.1 mg of sodium, 266mg of potassium, 27.93 mg of calcium, 7.03 mg of iron, 50.08 mg of ascorbic acid, 2500µg of β-carotene. (4)

We are generally concerned regarding the micronutrient content of green leafy vegetables because micronutrients like vitamins and minerals are the prime and main components of any leafy vegetables. But macronutrients like-carbohydrate, protein, fat, energy, dietary fibre, moisture and ash etc of kulekhara leaves should also be assessed, as all the macronutrient components present in conventional green leafy vegetables were already analysed and included in the book of : "**Nutritive Value Of Indian Foods"** by C. Gopalan. But there is no report regarding the macronutrient value of Kulekhara leaves in the above mentioned book. Because of less information regarding its nutritive values, people are unaware about this leaves and in spite of easy availability as well as low cost, people are very much reluctant to purchase it. So in our experimental study we tried to focus on the macronutrient component of this underutilized kulekhara leaves which were believed to be nutritious and might help in achieving nutritional security.

2. Aims & Objectives

- To identify the macronutrient component like-carbohydrate, protein, fat, moisture, fiber, ash and energy, present in Khulekhara leaves.
- To compare this value with the conventional green leafy vegetables.
- To aware the population regarding this underutilized, cheap, neglected and nutritious green leafy vegetables.

3. Materials and Method

The sample were prepared to analysis the nutrient by the following steps-

3.1 Collection of Sample

Kulekhara leaf was purchased from the local vegetable market.

3.2 Cleaning of sample

After purchasing the kulekhara leaves, those were thoroughly washed under the running tap water until all the dirt and other unwanted foreign material was depart .

3.3 Preparation of sample

- Kulekhara leaves, after completion of thorough wash was spread over the bloating paper and in the well airy space to absorb extra water from the leaves.
- Leaves were tap dry by using cotton towel to wipe out all the moisture.
- Each Leaf was then cut off from the steam.
- Leaves were kept in a zip lock air tight plastic bag in fresh condition and brought to laboratory for analysis in fresh condition.

4. Quantitative estimation of macronutrients in fresh kulekhara leaves

a) Estimation of Moisture

Moisture content was determined by drying 10 gm of sample in an oven at 105ºc and cooling in desiccators in a repetitative manner until a constant weight was achieved

$$\text{Moisture (\%)} = \frac{(wi/(wf)\times 100}{wi}$$

Where W_i is the initial weight and W_f is the final weight [5]

b) Estimation of ash

5g sample was weighed accurately into a porcelain crucible and was gently heated over a flame until the mass was completely charred. It was then transferred tomuffle furnace, heated at 600°C for 4 hours, cooled in a desiccator and weighed again. To ensure completion ofash preparation the crucible was again heated in the muffle furnace for 4 hours. This was repeated tilltwo consecutive weights were the same.

$$\text{Ash content (gm/100gm sample)} = \frac{W_a \times 100}{W_s}\ ^{(5)}$$

c) Estimation of Carbohydrate [6]

<u>For standard glucose preparatrion</u>

0.1 gm dextrose is dissolved in 100ml water. From this 1ml solution is taken & 9 ml distilled water is added to it. It is made up to 10ml. This is standered glucose solution.

<u>For anthrone preparationa</u>

0.2 mg of anthrone is added to 100 ml conc. ice cold H_2SO_4.

<u>For Test Sample</u>

0.1 gm fresh sample was weighed and 1ml HCL & 4ml distilled water was added to it. Then it was kept in water bath for 3hours for digestion. Then it was cooled to room temperature and neutralized by Na_2CO_3 . after that the volume made up upto 100ml by distilled water

d) Estimation of total protein by macro Kjeldahl method

2g sample was taken into a dry Kjeldahl flask and digested with 5g digestion mixture (98 parts K2SO4+ 2 parts CuSO4) and 20ml conc. H2SO4 for 4-5 hours at1000C.The content was then cooled, diluted with distilled water and the mixture made alkaline by adding excess of 40% NaOH. The ammonia liberated was distilled into a receiver containing 25ml of N/10 H2SO4.The excess of acid in the receiver was back titrated against N/10 NaOH using 3 drops of methyl red indicator. A reagent blank was similarly digested and distilled. This titre value wassubtracted from the value obtained for the sample to get the true titre value „b ". Calculation: If„a" g of the sample was taken and if„b" and „c" mlofalkali ofnormality „d" were required for back titration and to neutralize 25ml ofN/10 H2SO4 respectively then

$$\text{Protein content (gm/100gm sample)} = \frac{(c\text{-}b) \times (14\times d) \times 6.25 \times 100}{a \times 1000}\ ^{(5)}$$

a) <u>Estimation of fat</u>

Crude ether extract of the moisture free sample was used to estimate fat content. 5g dry sample was weighed accurately into a thimble which was placed in a Soxhlet apparatus and extracted with anhydrous ether for 16 hours. The ether extract was filtered into weighed conical flask. Now the ether was evaporated, cooled in a desiccator and weighed

$$\text{Fat content (gm/100gm sample)} = \frac{We \times 100}{Ws}$$

Where We is the weight of ether extract and Ws is the weight of the sample. [5]

b) <u>Estimation of fiber</u>

<u>2gm moisture and fat free sample (W_s)</u> was taken in a 500ml beaker, 200ml boiling 0.225N (1.25% W/V) sulphuric acid was added, boiled for 30 minutes keeping the volume constant by frequently adding water and the mixture was then filtered through muslin cloth and the residue washed with hot water till free from acid. The material was then transferred to the same beaker, 200ml boiling 0.313 N (1.25%) NaOH added, boiled again for 30 minutes, the mixture war again filtered through muslin cloth and the

residue was washed with water till free from alkali followed by washing with some alcohol & ether. Then the residue was transferred to a crucible and it was dried overnight at 80-100ºc in a oven. Then the crucible was weighed (We). After that the crucible was heated ion muffle furnace at 600ºc for 2-3 hours. Finally the crucible was cooled and weighed (Wa).

$$\text{Crude Fiber \%} = \frac{[100-(\text{Moisture}+\text{Fat})\times(\text{We}-\text{Wa})]}{\text{Weight of the sample}}$$

where wa is the weight of ash and ws is the weight of the sample. [7]

c) Energy estimation

The energy value of the 100g of food sample was calculated by using the following formula –

$$\text{Energy content} = (4\times Wc + 4\times Wp + 9\times Wf)$$

where wc is the carbohydrate content (g/100g), wp is the protein content (g/100g)and wf is the fat content (g/100g) [8]

5. Result & Discussion

Quantitative estimation of macronutrients content of kulekhara leaves

Table 1: Quantitative analysis of macronutrient content of fresh kulekhara leaves

Sl no	Parameter assessed	Results	Units
1	Energy	58.80	Kcal/100gm
2	Carbohydrate	12.2	gm/100gm
3	Fat	0.13	gm/100gm
4	Protein	4.69	gm/100gm
5	Fiber	1.80	gm/100gm
6	Total Ash	1.93	gm/100gm
7	Moisture	83.37	gm/100gm

The above table showed that kulekhara leaves contain considerable amount of carbohydrate, protein, energy, fiber and ash. 100gm fresh kulekhara leaves contain about 58.80kcal energy, 12.2 gm of carbohydrate, 4.69 gm of protein, 1.80gm of dietary fiber, 0.13 gm of fat, total ash 1.93 gm and moisture content is about 83.37 gm per 100 gm.

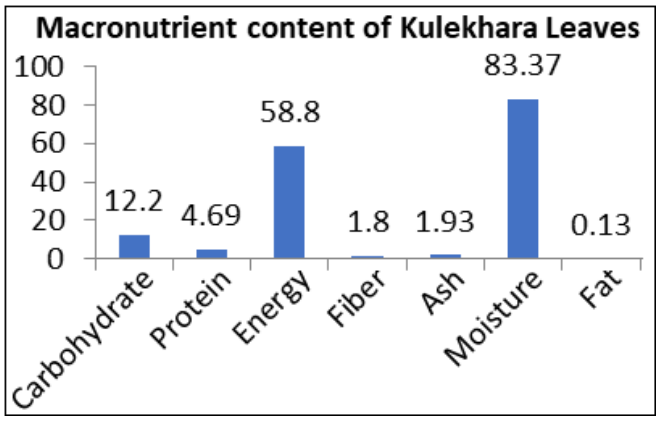

Figure 1: Graphical Representation of Macronutrient Content of kulekhara leaves

Table 2: Comparison of macronutrient content of conventional green leafy vegetables with kulekhara leaves

Name of leaves	Carbohyd rate (gm)	Protein (gm)	Fiber (gm)	Moisture (%)	Ash (mg)	Fat (gm)	Energy (Kcal)
Spinach	2.9	2	0.6	92.1	1.7	0.7	26
Amaranth	2.0	3.0	1.0	90	3.3	0.3	33
Bottle gaurd leaves	6.1	2.3	1.3	87.9	1.7	0.7	39
Ipomoea	3.1	2.9	1.2	90.3	2.1	0.4	28
Fenugreel leaves	6.0	4.4	1.1	86.1	1.5	0.9	49
Mustard Leaves	3.3	4.0	0.8	89.8	1.6	0.6	34
Kulekhara leaves	12.2	4.69	1.80	83.37	1.93	0.13	58.80

Table 2 showed that fresh kulekhara leaves contain much more carbohydrate, protein and fiber compared to other conventional vegetables like spinach, amaranth, ipomoea, bottle gourd and mustard leaves etc. It has also considerable low amount of moisture. 100 gm of fresh leaves contain 83.37% of moisture which are lowest amount among all the green leafy vegetables.

100gm of fresh kulekhara leaves provide **12.2 gm of carbohydrate**. This amount is richest compared to all the green leafy vegetables which are used in daily diet.

As we know green leaves contain very few amount of carbohydrate e,g- spinach, amaranth, ipomoea, mustard leaves provide only 2.9, 2.0, 3.1, 3.2 gm of carbohydrate respectively. So the consumption of kulekhara leaves in daily diet can provide considerable amount of carbohydrates.

Carbohydrate is considered as the main source of energy in the diet. Generally cereal and pulses are the primary contributors of energy sources. But the amount which is present in kulekhara leaves i.e 12.2gm/100gm, can be taken as a source of carbohydrate among all green leafy vegetables.

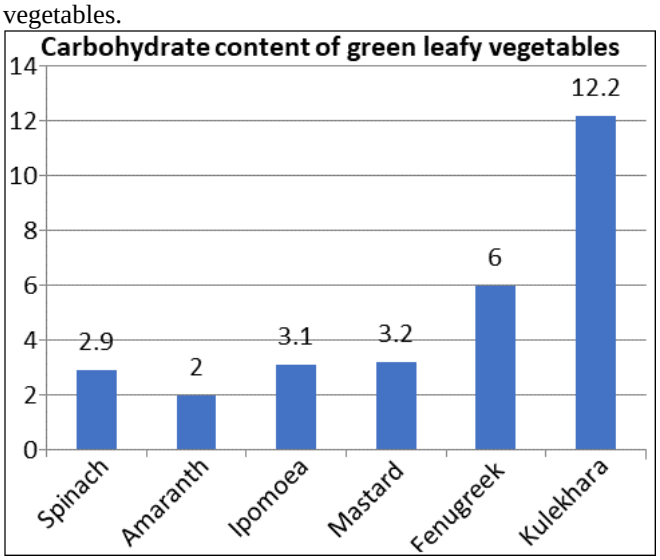

Figure 2: Comparison of carbohydrate content of kulekhara leaves with the conventional leaves

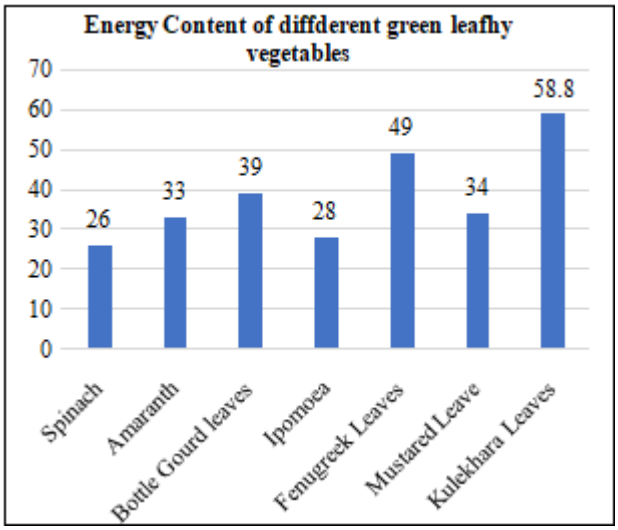

Figure 3: Energy content of different leafy vegetable

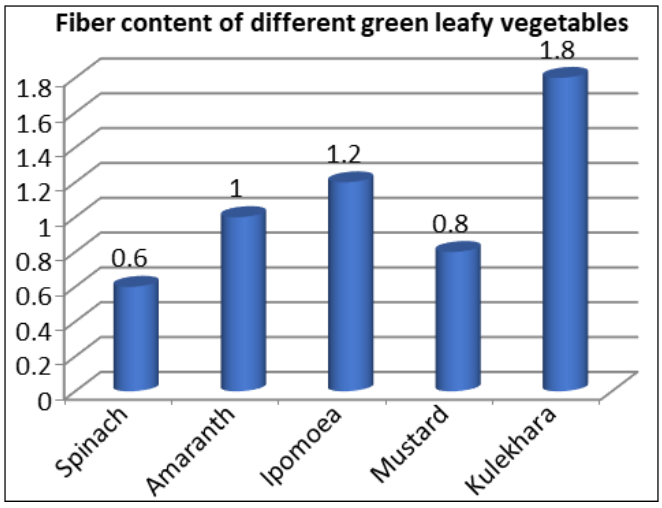

Figure 5: Graphical representation of fiber content of different green leafy vegetables

Table 2 showed, protein content of kulekhara leaves gets its achievement of highest value among other green leafy vegetables. Generally we know that animal sources are very good sources of protein and they are considered as first class protein. Whereas leafy vegetables is considered as a very poor sources of protein. In this studies, it has been found that kulekhara leaves contain very considerable amount of protein compared to other green leafy vegetables those are regularly consumed by common people.

People are very fond to consume different dishes prepared from spinach and it can be said that it is most consumable green leafy vegetable in India. But it contain lowest amount of protein that is only 2gm in 100gm which is stated in the books of "The Nutritiove Value of Indian Foods" by C. Gopalan. Beside this amaranth also contain very few amount of protein that is 3gm/100gm. Whereas kuekhara leaves which are most of the negligible leafy vegetable which contain **4.49 gm of protein per 100 gm.** So the consumption of kulekhara leaves alone as a green leafy vegetable or its preparation with the other protein rich foods can enhance the protein availability of particular meal.

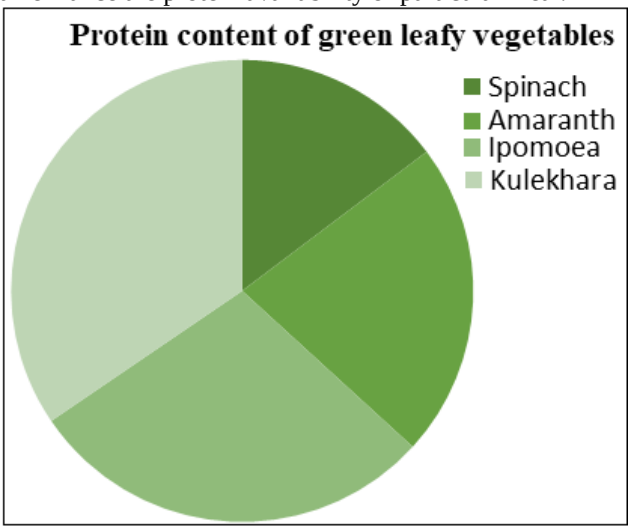

Figure 4: Comparison of protein content of kulekhara leaves with other leafy vegetables

The above graphical representation showed that kulekhara leaves contain highest amount of fiber compared to any other conventional green leafy vegetables. It showed that fiber present in kulekhara leaves is about **1.80gm /100 gm**. Whereas the fiber content of spinach is about 0.6gm/100gm. This amount is very much low compared to kulekhara leaves.

Dietary fiber has numerous therapeutic benefits likes it prevents constipation, control obesity, helps to lower blood sugar & blood cholesterol level and maintains colon health etc.

6. Conclusion

Quantitative estimation of macronutrients present in fresh kulekhara leaves indicate that it is rich in carbohydrate, protein, energy and fibre compared to other conventional green leafy vegetables, those are regularly consumed in our daily diet. In spite the presence of so many nutrients like macronutrients and micronutrients, in kulekhara leaves, it is generally not consumed by most of the population. These leaves are very much neglected to our modern society and people are very much reluctant to consume this. It can be prepared in so many ways to enhance its taste and increase its acceptability. It can also be utilized to improve the general health and nutritional status of the Indian population.

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Author Profile

Chitralekha Mukherjee received her B.Sc. and M.Sc. degrees in Food and Nutrition from University of Calcutta (C.U.) in 2005 and 2007 respectively. Currently, she is a Registered Research Scholar in the Department of Home Science, University of Calcutta, Kolkata, India. She is interested in identifying the importance of locally available, unconventional, neglected food and study their effects on experimental animals.

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