4. NUTRITIVE VALUE OF

*GISEKIA PHARNACEOIDES*

4.1 INTRODUCTION

In most developing tropical countries the food situation is worsening owing to increasing population, shortage of fertile land, high prices of available staples, and restrictions on the importation of food (Sadik 1991; Weaver 1994). This has resulted in a high incidence of hunger and malnutrition, a situation in which children and women, especially pregnant and lactating women, are most vulnerable (Coulter *et al*., 1988; Pelletier 1994).

Predictions of future food needs based on the current rates of population increase and food production emphasize the seriousness of this problem (FAO, 1990; FAO/WHO 1974). There can be no immediate single solution to the problem of food sufficiency. An interdisciplinary approach is necessary (Avery 1991). All information on new sources of food will be of value in dealing with the food problem (Masek 1966).

While every measure is being taken to boost food production by conventional agriculture, a lot of interest is currently being focused on the possibilities of exploiting the vast numbers of less familiar plant resources existing in the wild (Rao 1994; Felger 1979; US National Academy 1975). Many such plants have been identified, but the lack of data on their chemical composition has limited the prospects for their utilization (Vijayakumari *et al*,
Most reports on some lesser-known and unconventional crops indicate that they could be good sources of nutrients, and many have the potential of broadening the present narrow food base of the human species (Van Etten et al., 1967; Okigbo 1977; Aletor Aladetimi 1989; Janick and Simon 1990).

All human beings require a number of complex organic compounds as added caloric requirements to meet the need for their muscular activities (Encyclopaedia Britannica 1972). Carbohydrates, fats and proteins form the major portion of the diet, while minerals and vitamins form comparatively a smaller part. Plant materials form a major portion of the diet; their nutritive value is important.

The significance of wild plants in the nutrition of human population is increasing for several reasons. The studies of Yazzie et al., (1994) and Kim et al., (1997) reported the nutritional composition of baobab leaf and the seeds of Basica senegalensis which serve as food supplements. Smith et al., (1996) have also reported the nutritional composition and uses of wild foods.

Modern agricultural technology and marketing have caused a reduction in the genetic diversity of plant species, especially in vegetables, worldwide (Peron, 1992; Sun and Hang, 1998; Hang et al., 1998). Wild plants with a desired gene (resistance to diseases etc.) may be used in breeding programmes. Williams (1993) emphasized the need to preserve new plant resources to broaden the biological diversity in human nutrition. Recently a resurgence of interest has developed in wild species for their possible medicinal values in
diets (Varma 1982). Wild plant species provide minerals, fibre, vitamins and essential fatty acids and enhance taste and colour in diets. In addition, they have anti-bacterial, hepatoprotective and anticarcinogenic properties, and therefore having medicinal values (Green, 1992; Bianco et al., 1998).

_Gisekia pharnaceoides_, a plant of Molluginaceae family is found in Africa (Hutchinson, 1968), western and southern Asia and one species occurs in India (Wealth of India 2002). Recent studies on the histo-chemistry of the _Gisekia pharnaceoides_ leaf revealed the presence of starch, proteins, fats and oils and calcium oxalate in the leaf portion (Musa et al., 2006). Since the plant is being consumed as a vegetable in India, this study aims to investigate the nutritional value of the whole plant in detail.

4.2 MATERIALS AND METHODS

Dry powder of whole plant was used for determining the various nutritional parameters by different analytical techniques. The powder of dry plant was prepared as mentioned elsewhere in the Chapter 2 of this thesis.

4.2.1. Estimation of vitamin A

To a 3 g of the sample, 5 ml of 50 % (w/v) potassium hydroxide solution and 50 ml of alcohol were added and refluxed over water bath for 1 h. The solution was cooled and transferred to a 500 ml separator, to which 50 ml of hexane was added and shaken vigorously for 5 min. When the layers separate, the organic layer was passed through sodium sulphate into a 200 ml volumetric flask. The aqueous layer was shaken 3 times with 30 ml of hexane for each time.
All the organic layers were pooled together and diluted to 200 ml with the required hexane. The absorbance of organic layer was taken using spectrophotometer at 325 nm. The vitamin A content of the sample was calculated using the following formula (Indian Pharmacopoeia, 1996), where 1830 is a factor.

\[
\text{Vitamin A (IU)/100 g sample} = \frac{\text{Sample absorbance} \times 200 \times 1830 \times 100}{\text{Wt of sample taken}}
\]

The vitamin A is expressed as International Units, which refer to their biological potency. One IU is defined as the activity given by 0.03 g of vitamin A alcohol and 0.344 g vitamin A acetate.

4.2.2. Estimation of vitamin C (Indian Pharmacopoeia, 1996)

**Reagents:** Meta phosphoric - acetic acid solution (MPAA) was prepared by dissolving 15 g of Meta phosphoric acid in 100 ml of 40% (v/v) glacial acetic acid solution in water.

A 0.05% (w/v) of 2, 6 - dichlorophenol indophenol solution in water was prepared and the solution was filtered.

Standard solution of ascorbic acid was prepared by dissolving 0.05 g of L-ascorbic acid in 20 ml of MPAA solution and then diluted to 250 ml with water.
Sample solution: To 10 g of sample powder, 20 ml of MPAA solution was added and diluted to 500 ml with water. The solution was then filtered and used for assay.

Procedure

To 10 ml of standard ascorbic acid solution, 5 ml of MPAA solution was added and titrated against 2, 6 - dichlorophenol indophenol solution till pink color persisted for 10 sec. The titration was completed within 2 min and the titre value was noted. Sample solution (100 ml) was treated in the same manner and then titrated. The amount of ascorbic acid present in the plant powder was calculated as follows.

Ascorbic acid content of sample =

\[
\frac{\text{SAV} \times \text{STW} \times 10 \times 500 \times \text{STP}}{\text{STV} \times 250 \times \text{SAW} \times 100} \times 100 \text{ mg / 100g}
\]

Where,

\[
\begin{align*}
\text{SAV} & = \text{Sample titre value;} \\
\text{STV} & = \text{Standard titre value} \\
\text{STW} & = \text{Standard weight;} \\
\text{SAW} & = \text{Sample weight} \\
\text{STP} & = \text{Standard purity}
\end{align*}
\]

4.2.3. Estimation of Riboflavin

Riboflavin content of the plant sample was assayed according to the method of Indian pharmacopoeia (1996).
Briefly, to a 5 g of sample powder, 150 ml of water and 5 ml of glacial acetic acid were added. The solution was boiled for 5 min and cooled. To this, 30 ml of 0.1 M sodium hydroxide solution was added and diluted to 500 ml with water. The solution was then filtered and absorbance was measured at 444 nm in Shimadzu UV -1201 Spectrophotometer. Water was used as blank. The amount of riboflavin present in 100mg sample was calculated as follows:

\[
\text{Riboflavin content of sample} = \frac{SA \times 500 \times 100}{328 \times SW} \text{ mg / 100g}
\]

Where,

- 328 - Molar extinction coefficient ;  
- SA - Sample absorbance  
- SW - Sample weight.

4.2.4. Estimation of Thiamine

(i) Preparation of buffer solution

To 6.8 g of potassium di-hydrogen phosphate, 8 ml of 1 M potassium hydroxide solution was added and diluted to 1000 ml with water.

(ii) Dye solution:

Bromothymol blue, 0.06 g, was dissolved in 100 ml of chloroform.

Thiamine hydrochloride - stock solution:

Thiamine hydrochloride (100 mg) was dissolved in 100 ml of water.
(iii) Thiamine hydrochloride standard solution

One ml of stock was diluted with 100 ml of buffer solution.

Sample solution

To 10 g of sample powder, 100 ml of buffer was added and filtered, after thorough shaking. The filtrate was used for assay.

Procedure

Estimation of Thiamine was carried out by the following (United States Pharmacopoeia (2000) method.

Briefly, a 10 ml sample solution and a 10 ml of working standard solution were taken in two different dry separating funnels. A 10 ml each of chloroform dye solution was added to both the standard and sample solutions and then shaken for 2 min continuously. Then, they were allowed to stand for 5 min with occasional shaking. The chloroform layer was collected by passing it through anhydrous sodium sulphate. The absorbance of the aliquots of the filtrate was read at 420 nm using Shimadzu UV-118 Spectrophotometer. The chloroform was used as blank. Thiamine hydrochloride content of the sample was calculated as follows:

Thiamine hydrochloride content of sample =

\[
\frac{SAA \times STW \times 10 \times 100 \times STP}{STA \times 100 \times 100 \times SAW \times 10} \times 100 \text{ mg} / 100 \text{ g}
\]
Where,

\[
\begin{align*}
SAA &= \text{absorbance of sample solution;} \\
STA &= \text{absorbance of standard solution} \\
SAW &= \text{Sample weight;} \\
STW &= \text{Standard weight} \\
STP &= \text{Standard purity.}
\end{align*}
\]

The content of thiamine alone in the sample of plant powder was calculated as follows:

\[
\text{Thiamine (mg/100g) content of sample} = \frac{\text{Thiamine HCl (mg)/100 g of sample } \times \frac{\text{M.wt. of thiamine (300.77)}}{\text{M.wt. of thiamine HCl (337.2)}}}{100 \text{ g}} \text{ mg / 100 g}
\]

4.2.5 \hspace{1em} \textbf{Elemental Analysis of Sample}

\textbf{Procedure}

Analyses of minerals and trace elements of whole plant of \textit{Gisekia pharnaceoides} were done using Atomic Absorption Spectrophotometer Perkin Elmer model 2380. Quantification of elements such as calcium, iron, magnesium, copper, manganese, zinc, chromium, cadmium and lead present in the sample was done according to the method of Hack (2000).

The sample preparation was done by drying the plant at 80°C for 12 h. then, ground finely and 1 g was taken in a 100 ml beaker and 5 ml of
concentrated nitric acid and 2 ml of perchloric acid were added to the sample. It was covered with a watch glass and digested by heating to obtain a final volume of 3 - 5 ml. Evaporating the solution to dryness can cause loss of more volatile elements such as As, Se etc. Then, 10 ml of water was added to the beaker and the digested solution was filtered through an acid washed filter paper into a 50 ml volumetric flask. The filter paper was washed with water and the filtrate was made up to required volume with de-ionized water. Aliquot of this sample was used for the study of elements by atomic absorption spectroscopy.

4.2.6. Proximate analysis of plant powder

4.2.6.1. Determination of moisture content by IS (1990) method.

Five gram of the powered sample was taken in a tarred aluminium dish with a cover, having a diameter of atleast 50 mm and a depth of about 40 mm. The cover was removed and the dish was placed in a hot air-oven maintained at 105 ± 2°C and dried for at least 1 h. Then, the dish was covered with the cover, cooled in a desiccator and weighed. The process of heating, cooling and weighing was repeated until the difference in mass between two successive weighing was less than 1 mg, and the percentage moisture was calculated as follows:

\[
\text{Percentage of moisture} = \frac{100 \times (M1 - M2)}{(M1 - M)}
\]

Where,

\[
M1 = \text{Mass in g of the dish with the material before drying}
\]
\[
M2 = \text{Mass in g of the dish with the material after drying}
\]
\[
M = \text{Mass in g of the empty dish.}
\]

Sample was digested in \( \text{H}_2\text{SO}_4 \), using \( \text{CuSO}_4 \) as catalyst, converting the nitrogen to ammonium sulphate. The subsequent liberation of ammonia upon distillation is absorbed by sulphuric acid which is then back titrated against sodium hydroxide.

**Procedure**

A known quantity of powdered dry sample was digested with concentrated sulphuric acid using \( \text{K}_2\text{SO}_4-\text{CuSO}_4 \) mixture as catalyst, in a digestion flask. The heat mediated acid digestion was continued until the sample becomes colourless. The digest was then cooled to room temperature and the content of the digestion flask was cautiously poured into standard flask (250 ml) containing precooled double distilled water of about 100 -150 ml. The total volume of the digest was made upto 250 ml by washing the digestion flask and transferring the wash liquor to the standard flask. This sample was used for distillation with 45% sodium hydroxide solution. The distillation was continued till all the ammonia passed over into a 20 ml of standard 0.1M \( \text{H}_2\text{SO}_4 \) solution. The ammonia being an alkali neutralizes the \( \text{H}_2\text{SO}_4 \) and forms ammonium sulphate. The excess \( \text{H}_2\text{SO}_4 \) was quantified by back titration with 0.1M \( \text{NaOH} \) using methyl red as indicator. Blank correction was made using all reagents except the sample. Nitrogen determination for standard \( (\text{NH}_4)_2\text{S0}_4 \) was also done in the same manner, in place of the sample. The percentage of protein was calculated as follows:
(Blank titre value - sample titre value) x 
Strength of NaOH x 1.4007 x 6.25

\[
\text{Percentage of protein} = \frac{\text{Strength of NaOH} \times 1.4007 \times 6.25}{\text{Weight of sample taken}}
\]

Where

\[
\begin{align*}
6.25 & \quad = \quad \text{Nitrogen factor} \\
1.4007 & \quad = \quad \text{Equal to protein in lysine HCl.}
\end{align*}
\]

4.2.6.3. **Determination of crude fat**

**Reagents**

- Petroleum ether of boiling range 40°C to 60°C
- Hexane, food grade conforming to IS: 3470-1966.

**Procedure**

The powder sample (5 g) heated at 105 ± 2°C for at least 2 h was extracted with petroleum ether in a Soxhlet extractor. Extraction was done at a condensation rate of 5 to 6 drops per second for 4 h initially, and then 2 to 3 drops per second for 16 h. The extract was dried on a steam-bath for 30 min, cooled in a desiccator and weighed. Alternate drying and weighing were done at 30 min intervals until the difference between two successive weighing was less than 1 mg and the lowest mass was noted (IS, 1990). The percent of crude fat content in the plant sample was calculated as follows:

\[
\text{Percentage of crude fat (on moisture free basis)} = \frac{100 \times (M_1 - M_2)}{M}
\]
Where,

\[ M_1 = \text{Mass (in g) of the extraction flask with dried extract (fat wt.)} \]
\[ M_2 = \text{Mass (in g) of the extraction flask (flask weight)} \]
\[ M = \text{Mass (in g) of the dried sample taken for the test.} \]

4.2.6.4. Determination of the crude fibre

Reagents

Sulphuric acid - 0.255 N (1.25% v/v), accurately prepared
Sodium hydroxide solution 0.313 N (1.25% w/v), accurately prepared.

Procedure

Crude fibre content of the *Gisekia pharnaceoides* powder was determined according to IS 1990 method. Known (2 gm) weight of the moisture free and fat free sample was used in this study. This residue was refluxed with 1.25 % H₂SO₄ (200 ml) for 30 min. The contents were then filtered through fine linen held in a gooch crucible. After filtration the residue was washed with boiling water followed by 1.25% NaOH solution. The residue was then washed with hot water to remove the salt formed in the process of acid base reaction. Further, the residue was treated with 1% HNO₃ solution and again with hot water to remove residual alkali and salt / acid respectively. The salt free residue obtained was heated to 105°C until the moisture is totally evaporated. The residue was then incinerated at 600 °C in a muffle furnace for about 4hr, after taking the weight of the moisture free residue. The crucible containing the ash was cooled in desiccator and weighed (IS, 1990). The crude fibre content was
calculated by calculating the loss in weight.

\[
\text{Percentage of crude fibre (on moisture free basis) } = \frac{(M1 - M)}{(M2 - M)} \times 100
\]

Where,

\[
\begin{align*}
M1 & = \text{Mass (in g) of Gooch crucible containing ash} \\
M2 & = \text{Mass (in g) of Gooch crucible with sample} \\
M & = \text{Mass (in g) of Gooch crucible.}
\end{align*}
\]

**Carbohydrate content**

The carbohydrate content was calculated by subtracting the cumulative percentile figure of the moisture, fat, protein and ash from 100. The calculation is expressed as, 100 – (% ash + % moisture + % fat + % protein).

**Nutritive value**

Nutritive value was calculated from the proximate principles assuming that the proteins, carbohydrates and fats yield 4, 4 and 9 kcals respectively per gram. (IS 1990 and 1991). Therefore the nutritive value (NV) is expressed (Indrayan, 2005) as = [(4 x % protein) + (9 x % fat) + (4 x % carbohydrate)].

**4.4 RESULTS**

The proximate compositions of the plant of this study, in powder form, are reported in Table 4. The shade dried plant powder showed a moisture content of 11.8 percent and this sample was taken for further analysis and the results are expressed on dry matter basis. The plant *Gisekia pharnaceoides*
seems to have a wide variation in composition. The crude protein content was found to be more than 9 percent, while the fat content was one third of the protein level. The crude fibre content of whole plant in powder form was observed to be 8 percent on moisture free basis. The total ash content of the plant was 7.4 g /100 gm. The total carbohydrate was calculated to be about 68-70 percent. The gross nutritive energy obtained from 100 gm of the dry *Gisekia pharnaceoides* powder was calculated to be 338 kcal.

The powdered plant material was analysed for vitamin A, B₁ (Thiamine), B₂ (Riboflavin), and C (Ascorbic acid) and the results are presented in Table 5. The content of different vitamin types in the *Gisekia pharnaceoides* is 3430 IU, 0.08 mg, 22.93 mg and 4.65 mg respectively for vitamin A, B₁, B₂ and C. Presented in Table 6 are the mineral contents of *Gisekia pharnaceoides*. Apart from the major elements require for human metabolism the macronutrients are also found to be present. Analysis of the plant sample also showed the presence of toxic elements in traces, which are in below detectable level (Table. 6). The overall nutritional status of various other edible plants reported earlier is presented in Table. 7 for comparison.

4.5 DISCUSSION

An adequate provision of all nutrients in the correct proportions is a prerequisite for human health. Nutrients are necessary for growth of the whole body, cellular and chemical structure and repair and provision of energy (Fieldhouse, 1986). It is not surprising that since prehistoric times man has been trying to find more useful plants and to improve the yield and the quality
of the known ones; this has resulted in the knowledge of uses for numerous plants. Revolution in industrialization has altered cooking and eating habits. Appropriate nutrition requires that all nutrients, carbohydrates, lipids, proteins, minerals, vitamins and water are eaten in adequate amounts and correct proportions. This is essential for normal organ development and function, reproduction, repair of body tissues and combating stress and diseases. The nutrient intake should be appropriate for sustained activity and effective physical work (Hexted, 1975; Chopra 1991). Diseases due to the deficiencies of proteins and calories occur commonly. These are (i) Kwashiorkor, (ii) Nutritional marasmus (iii) Marasmic Kwashiorkor.

Most of our carbohydrates and proteins are major supply of vegetables. Archeological evidence indicates that more than 3000 species have been used for food. Nutritional value of various edible plants has been reported earlier by different investigators (Lorenz and Maynhart 1980; McCollum 1992). Apart from this, the nutritional value of some of the wild plants has also been reported (Yildirim et al., 2001). The herb chosen for the study in the present investigation also belong to a wild plant type and being used for edible purpose in some parts of India. The protein content, > 9% as seen from Table 4, shows that Gisekia pharnaceoides is a rich source of protein compare to other edible plants (Lorenz and Maynhart 1980; Coulter et al., 1998). The commonly used vegetables such as lettuce, spinach, parsley and cabbage contain protein of 1-3% range. Even some of the plant seeds show lower protein content in the range of 4 -7 %. The recommended daily intake of protein is 50 g/day for a normal adult. Whereas, the Gisekia
Gisekia pharnaceoides, as a vegetable, when used as part of meal would substantially supplement the protein to the human diet (Kiritikar and Basu 1933). Since Gisekia pharnaceoides is a wild plant and yet to be more familiar for edible purpose, the quality of this protein in terms of amino acid composition is still to be analyzed. The protein of Gisekia pharnaceoides, presumably with better amino acid profile may serve as a nutrient as well as a drug. Because, proteins are required not only for muscle building but also for strengthening the immune functions of the system. Milk, meat, egg are known as rich sources of protein but cannot be affordable to all sections of population due to the living place, life style and so on. Even the traditional vegetables too become costlier in the globalization era. Under such situations, wild plants such as Gisekia pharnaceoides could serve as good source of protein, of course in combination with other proteins, to alleviate malnutritional syndromes such as ‘Kwashiorkor’ and ‘marasmus’.

A high carbohydrate content of 68% found in Gisekia pharnaceoides might have been contributed by soluble carbohydrates and crude fibre. The presence of carbohydrate in the leaf of Gisekia pharnaceoides has been detected by chemo-microscopy by musa et al., 2006. Their pharmacognostic study revealed the presence of starch grain, lignin, cellulose, gums and mucilage etc. Carbohydrates are compounds that include sugar, fibre, starch, and their related compounds. The observed 8.1% crude fibre content in the Gisekia pharnaceoides (Table. 4), may be the combination of hemicellulose, cellulose and lignin. The recommended daily intake of carbohydrate for normal adult is 300 g /day; whereas the fibre is 25 g /day. Carbohydrates are
required to maintain healthy functioning of the organs and are a major source of energy for the body especially for brain and nervous system. The appreciable amount of fibre content of *Gisekia pharnaceoides* could support the normal movement of bowels by stimulating peristalsis. The fibre content is also known to provide roughage value.

Vitamins can be broadly classified as water soluble and fat soluble vitamins. B-complex vitamins and ascorbic acid belong to the former group while vitamin A, D, E, and K belong to the later. The wild plant of this study is observed to contain an appreciable amount of vitamins such as vitamin A, vitamin B₁, vitamin B₂ and vitamin C. However the plant was not analyzed for other vitamins which are also likely to be present. The commonly consumed green leafy vegetables are rich source of β-carotene, vitamin C, riboflavin, folic acid and other nutrients that are required for growth and maintenance of health (Gopalan et al., 1989). In this study, the nutritive value of *Gisekia pharnaceoides* was determined for the first time and reported in this thesis. This attempt was made based on the observation of the earlier chapters relating to the phytochemical and pharmacological properties of the plant.

Vitamin A, a derivative of β-carotene, is identical to retinal (McClaven 1980) and is necessary for clear vision in dim light. Dietary deficiency of this vitamin results in eye malfunctions such as night blindness, and xerophthalmia. The present study showed that the vitamin A in *Gisekia pharnaceoides* was 3430 IU/100g (Table. 5) and therefore suggests that *Gisekia pharnaceoides* can be a good source of vitamin A in the daily diet.
The another vitamin detected in this plant was thiamin, one of the water soluble B group vitamins essential for carbohydrate metabolism, maintenance of normal neural activity and prevention of beriberi. This vitamin needs to be supplemented from outside the body either through food or as drug. The important sources of this nutrient are plants and its parts and products. Daily requirement of vitamin B₁ ranges from 0.5 and 2 mg / day depending upon age, physiological status and level of daily physical activity (Chatterjea and Shinde 1997). Its deficiency causes “beriberi” in human being.

The *Gisekia pharnaceoides* seems to be a rich source of riboflavin (>20 mg /100 g) comparing the recommended daily intake of this vitamin (1.7 mg/day). This vitamin is also a part of B complex vitamin, present in milk, egg and green vegetables. Riboflavin has been reported to be photosensitive and therefore a 25% loss in the vitamin content in alfa-alfa exposed to bright sunshine for 48h. (Hunt and Bethke 1940). Hence, *Gisekia pharnaceoides* was processed in shade and the powder material thus obtained was analyzed for riboflavin content. Vitamin B₂ as part of a coenzyme is essential for several oxidation processes inside the cell and is concerned with energy and protein metabolism.

Natural ascorbic acid is vital for the body performance (Okwu, 2004). Lack of ascorbic acid impairs the normal formation of intercellular substances throughout the body, including collagen, bone matrix and tooth dentine. A striking pathological change resulting from this defect is the weakening of the endothelial wall of the capillaries due to a reduction in the amount of
intercellular substances (Hunt et al., 1980; Okwu, 2004). Therefore, the clinical manifestations of scurvy in hemorrhage from mucous membrane of the mouth and gastrointestinal tract, anemia and pain in the joints can be related to the association of ascorbic acid and normal connective tissue metabolism (Hunt et al., 1980, Okwu, 2004). This function of ascorbic acid also accounts for its requirement for normal wound healing.

It is rather difficult to ensure adequate supply of this vitamin in a predominantly vegetarian diet (Ambika Shanmugam 1997). Contrarily, the *Gisekia pharnaceoides* is found to be a rich source of riboflavin. Some of the edible plants are good sources of ascorbic acid and some B vitamins. (Okwu and Josiah 2006), and the *Gisekia pharnaceoides* of the present study too falls in the line showing about 4.65 mg/100g (Table.5).

Vitamin B₂ as part of a coenzyme is essential for several oxidation processes inside the cell and is concerned with energy and protein metabolism. Some of the clinical symptoms attributed to inadequate intake of this vitamin in the diet are the soreness of the tongue (glossitis) cracking the angles of the mouth (angular stomatitis), redness of the eye and burning sensation in the eyes, scarceness of the skin in the region between the nose and the angles of the lips (Seborrheic dermatilis). Scrotal dermatitis can also be a result of riboflavin deficiency. Among the several B-Complex vitamins, riboflavin deficiency is the most widespread, particularly among children and women in India (Deb, 1997). This study therefore provides some nutritional basis for the wild plant, *Gisekia pharnaceoides* for the dietary use in the prevention of vitamin deficiency disease. Despite being potential source
antioxidants (Vitamins) of different kinds, this plant could also serve as a potential food supplement in daily rations.

Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter. In other words, the ash content (Table. 4) represents the total mineral content which was found to be 7.4 % in the present analysis for *Gisekia pharnaceoides*. The determination of ash level in the food stuff is a part of the proximate analysis for nutritional evaluation. The elemental analysis data (Table.6) of the plant material suggest that the plant material is rich in mineral of nutritional importance. A large number minerals and trace metals present in the body are supplied by diet. Minerals are unique nutrients because of their important role in metabolism. They are an essential part of many important enzymes and they also play roles as catalysts and antioxidants. The important minerals required for various body functions are: calcium and phosphorus for the formation for bones and teeth; sodium, potassium and phosphorus for maintaining water balance in the body (Swaminathan, 1999). Whereas sodium and potassium take part in ionic balance of the human body and maintain tissue excitability. Because of the solubility of salts, sodium plays important role in the transport of metabolites. Potassium is of importance as a diuretic. The sodium and potassium content in *Gisekia pharnaceoides* are found to be 59 and 193 mg respectively per 100 g plant material. Since the human body requires these minerals to an extent of 2400 mg sodium and 3500 mg potassium per day. Therefore this plant could be a source of these minerals, if included in diet.
Besides the bone formation function, calcium is also required for human extracellular fluid, normal functioning of cardiac muscles, blood coagulation and cell permeability. The availability of calcium in *Gisekia pharnaceoides* is the highest (410 mg /100 g) of all the minerals and therefore the plant could be one of the best dietary sources of calcium. Apart from these minerals, other elements required for the functioning of human body are iron, magnesium, copper, manganese, zinc, sulphur, iodine and phosphorous etc. The important of iron is well known for the production of hemoglobin that enables the blood to carry oxygen throughout the body. The level of magnesium (15 mg) is higher than that of iron (9 mg) in this plant. In humans magnesium is required in the plasma and extra cellular fluid, where it helps to maintain osmotic equilibrium. Also, it is required in many enzyme-catalysed reactions. Copper is also a component of many enzyme systems such as cytochrome oxidase, lysyl oxidase and iron-oxidizing enzyme in blood (Mills 1981). This element is involved in normal carbohydrate and lipid metabolism (Hambidge *et al.*, 1987). This element is also present in *Gisekia pharnaceoides* to a level of 0.26 mg, which is about 13% of the recommended daily requirement (2 mg). Chromium regulates the action of insulin and is also essential in carbohydrate and lipid metabolism (Alam and Mahpara 2003), and is found in traces in the plant.

Zinc is a multifunctional nutrient involved in glucose and lipid metabolism, hormone function and wound healing (Hambidge *et al.*, 1978) and is also associated with proper hair growth (Wang *et al.*, 1985). Presence of this element in 100 g dry matter is equivalent to that of its 70% daily
requirement. This is a component of many metallo enzymes, including some enzymes which play a central role in nucleic acid metabolism (Atukorala et al., 1987; Alibi 1987). Its deficiency leads to impaired growth and malnutrition (Prasad 1981). Manganese was also a component of the mineral profile of *Gisekia pharmaceoides* and its level is relatively higher than that of copper and phosphorous. It is also essential for hemoglobin formation (Ohsuka et al., 1984). Other minerals like arsenic, lead and mercury are present in traces.

Relatively higher mineral content has been reported to be present in the harder portion of bottle gourd, except, K, Cu, Na and Mg which was more in the soft portion of vegetable (Modgil et al., 2004). Additionally, they have found higher amount of Ca, Fe, P, Zn and Mg in the harder region (peel). Despite the higher content of these elements in the harder portion of this plant, it also rich in crude fibers. Therefore the hardness may be due to the combined contribution of the fibre and these minerals. However the Na, K, Cu and Mg reported to be present in the soft portion (Modgil et al., 2004), may be in free form and therefore would be easily available for assimilation. Of all these elements, magnesium, the third biggest partner of the miner family in *Gisekia pharmaceoides*, should be present in both hard as well as soft regions of the plant, as has been observed by Modgil et al., (2004). Besides the nutritional, value the results in (Table. 6) also suggest that the *Gisekia pharmaceoides* of this region is a mineral efficient plant and therefore is more drought resistant and require less irrigation, as noticed by Glew et al., (1997) for plants of Burkina Faso. This study therefore provides some
nutritional bases for the wild plant *Gisekia pharnaceoides*, for the dietary use in the prevention of vitamin deficiency diseases. Despite being potential source antioxidants (Vitamins) of different kind, this plant could also serve as a potential food supplement in daily rations.
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