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Studies on nutritional, chemical and mineral composition of horse gram

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Abstract

Horse gram (*Macrotyloma uniflorum*), a traditional tropical legume is the cheapest source of protein and an excellent supply of minerals such as calcium, iron and molybdenum. The nutrient composition and mineral composition of horse gram seeds were evaluated of their flour characteristics. The objective of the present study was to evaluate horse gram seed with the aim of quantifying physiochemical properties information that might serve as a guide to exploit its potential and benefits for human and animal nutrition. The proximate compositions (%) were determined as moisture content (8.05 ± 0.6), ash (3.91 ± 0.10), total crude fibre (3.9 ± 0.04), crude carbohydrate (58.2 ± 0.16), crude fat (0.45 ± 0.02), and crude protein (21.87 ± 1.07). The present study may provide a guideline for the use of horse gram seed flour as good functional foods for nutrition, food formulation and utilization. Horse gram seeds containing macro nutrients like Ca, P, K and micronutrients like Mg, Zn, Cu, Fe and Mn are the major plant nutrients. Different parts of the plants are used for the treatment of heart disease, asthma, bronchitis, urinary discharges and for treatment of kidney stones. The present paper is showing its medicinal uses and pharmacological properties.

Keywords: Horse gram, nutrients, proximate composition, health benefits, medicinal uses

Introduction

Horse gram is one such legume, which is easy to grow, resistant to pests and diseases, appeal to the eye and to the palate and highly nutritious. Horse gram is one of the important grain legume crops of India. It is essentially a crop for the dry tropics and is grown in area of moderate rainfall. It is drought resistant and adoptable to poor soil conditions unlike other pulses. (Kumar, 2006) [4]. Horse gram is an underutilized pulse crop grown in wide range of adverse climatic conditions. It occupies an important place in human nutrition and has rich source of protein, minerals, and vitamins. Besides nutritional importance, it has been linked to reduced risk of various diseases due to presence of non-nutritive bioactive substances. These bioactive substances such as phytic acid, phenolic acid, fiber, enzymatic/proteinase inhibitors have significant metabolic and/or physiological effects. (Prasad and Singh, 2015) [6]. Food legumes are second most important group of crops after cereals which have been a vital ingredient of balanced human diet since millennia and recognized as second most valuable plant source for human and animal nutrition. In the developing countries, primarily a handful of conventional legumes dominating the production and market chains and playing crucial role in eradicating protein malnutrition still, some of the underutilized indigenous legumes like, horse gram has great significance in the nutritional security of rural, tribal and underprivileged masses. Horse gram is one of the highly nutritious vegetable pulse crops with ethno-medicinal values in India. (Bhartiya *et al.*, 2015) [2]. Horse gram is extensively cultivated in South Indian States i.e., Karnataka, Andhra Pradesh and Maharashtra. It is also cultivated in parts of Bengal, Bihar, Himachal Pradesh, Orissa and foot hills of Uttar Pradesh. (Sundarraj and Thulsidas, 1986) [9].

Grain legumes are an important source of nutrients and renowned as poor man's meat especially in developing countries. Horse gram has been recognised as potential source of protein and other nutrients. It has high nutritional value equivalent to other commonly grown pulse crops in all aspects and also an excellent source of iron, molybdenum and calcium. (Bhartiya *et al.*, 2015) [2]. The horse gram, *Macrotyloma uniflorum* (Fabaceae) is normally used to feed horses, though it is also commonly used in dishes. In traditional ayurvedic cuisine, horse gram is considered a food with medicinal qualities.

It is prescribed for persons suffering from jaundice or water retention and as part of a weight loss diet. (Marimuthu and Krishnamoorthi, 2013) [5].

Health benefits and Medicinal uses

Horse gram has high non-digestible carbohydrate content which cause lower glucose release into the blood stream with potential beneficial effects in the dietary management of diabetes and this resistant starch is regarded as a prebiotic among the new generation of dietary fibre. Horse gram protein comprises higher lysine content than pigeon pea and chickpea making it a good complement to a cereal based diet. The high content of dietary fibre in horse gram flours might be helpful in terms of maintaining positive effects on intestine and colon physiology, besides other homeostatic and therapeutic functions in human nutrition.

The horse gram plant exhibits the properties of astringent, diuretic and antioxidant. It is used in the treatment of many health problems specially to treat diarrhea, hemorrhage and hemorrhoids. In curing the menstrual problems, leucorrhoea and bleeding during the pregnancy period horse gram plant works effective. The regular intake of horse gram helps to flush out the worm infections, it regulates the digestive system and ward offs acidity and flatulence. Horse gram also helps in lowering cholesterol levels (Ramteke *et al.*, 2016) [7]. Pulse crops are excellent sources of protein, dietary fiber, micronutrients and phytochemicals. In addition to nutrients, it can also supply many bioactive substances in small quantities which have significant metabolic and/or physiological effects. These bioactive substances are referred as non-nutrient bioactive compounds, *viz.* phenolic acids, flavonoids and high molecular tannins. These compounds contain potential medicinal/nutraceutical properties and have inhibitory role in reduction of various diseases like, coronary heart diseases, diabetes, and obesity.

The term nutraceutical introduced in 1989 by Stephen DE Felice can be defined as, a food (or part of a food) that provides medical or health benefits, including the prevention and/or treatment of a disease. In simple terms, nutraceuticals are those foods or parts of foods that provide health and/or medical benefits including prevention, protection and treatment of a disease. In view, of its medicinal synergy, economical status and no side effects, the nutraceuticals, functional or health foods have gained a wide interest during the last few decades. The health promoting effects of phytochemicals and nutraceuticals and/or functional foods are likely due to a complex mix of biochemical and cellular interactions which together promote overall health of the individual. The clinical success of nutraceutical products coupled with increasing health consciousness results in rapid global growth of the nutraceuticals and functional food industry. The major chemical compounds recognized as potential health promoting benefits are the phenolics, flavonoids, alkaloids, carotenoids, prebiotics, phytosterols, tannins, fatty acids, terpenoids, saponins, and soluble and insoluble dietary fibers.

Plant materials play major role in primary health care. Scientist have claimed that the grain legumes effectively contribute to a balanced diet and can prevent widely diffused diseases, including type II diabetes and cardio vascular diseases. The extracts from *M. uniform* seeds had significant activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. Different parts of the horse gram plants are used for the treatment of heart conditions, asthma, bronchitis, leukoderma, urinary

discharges and for treatment of kidney stones. (Prasad and Singh, 2015) [6].

Medicinal uses

Horse gram has long history as traditional medicine to cure many diseases, still it is neglected for its remedial potential. As per *Charak Samhita*, the seed of horse gram are useful for the cure of piles, hiccup, abdominal lump, bronchial asthma, in causing and regulating perspiration and in the *Sushruta Samhita* it is mentioned that the seed powder is useful in stopping excessive perspiration. Traditional texts describe its use as traditional medicine for curing kidney stones, asthma, bronchitis, leukoderma, urinary discharges, heart diseases and piles. It also has anthelmintic activity which can be used as dietary food for infants to eradicate worms. It supposed to have unique property of dissolving kidney stones, therefore, in many parts of the country it is given to prevent or cure urinary stones. In seed extract of horse gram water soluble, heat stable, polar, non-tannin and non-protein crystallization inhibitors are reported and a marked decrease in anti-calcifying activity observed with the post-harvest storage of seeds. The extract of horse gram exerts a hypolipidemic and hypoglycemic actions and has also been found beneficial in urinary troubles, acid peptic disorder (gastritis), constipation, sun-burn, kidney stone, female diseases (leucorrhoea, menstrual troubles, bleeding during pregnancy, post-partum excessive discharges), colic caused by wind, piles, rheumatism, hemorrhagic disease, intestinal worms *etc.* It is prescribed for persons suffering from jaundice, water retention, as part of a weight loss diet, iron deficiencies and also helpful for maintaining body temperature in the winter season. It is considered as *Garmi dal* and preferred during the winter months by rural communities. Horse gram seed are rich source of dietary antioxidants as well as has antidiabetic effect. Extracts from horse gram seeds reported to have significant activity against *B. subtilis*, *S. aureus*, *E. coli*, and *P. aeruginosa*. Horse gram used as medicine to treat hiccups, worms and in the treatment of bacterial and fungal infections. It has functional ingredients against hypercholesterolemia and obesity. (Bhartiya *et al.*, 2015) [2].

The soup extract from kulaththa (Horse gram), called yusa, was consumed commonly during the Sutra period (c. 1500-800BC) are the rasams of today. Horse gram is widely grown for human food as a pulse and fodder crop for livestock as well as green manure and medicinal crop. In rural areas, seeds of horse gram are consumed after parched followed by boiling or frying along with cooked rice, sorghum or pearl millet. Sprouted seeds, having high nutritional quality, are widely consumed by the indigenous tribal peoples. Even now, in addition to its nutritive value, the consumption of sprouted seed become increasingly popular due to the excellent source to reduce the risk of various diseases and exerting health promoting effects. In Indian traditional medicine, seeds of horse gram are used for treatment of urinary stones, urinary diseases and piles, regulate the abnormal menstrual cycle in women, act as astringent, tonic, and also used to treat calculus afflictions, corpulence, hiccups, and worms. Furthermore, the cooked liquor of the horse gram seeds with spices is considered to be a potential remedy for the common cold, throat infection, fever and the soup said to generate heat. (Prasad and Singh, 2015) [6].

Materials and Methods

Horse gram were obtained from local area of Parbhani region. Chemicals and reagents (analytical grade) and standards taken

from laboratory, Department of Food chemistry and nutrition, College of Food Technology, Parbhani.

Methods

Chemical analysis of horse gram

All samples were analysed for the moisture, ash content, protein content, fat content, minerals and yield of horse gram.

Moisture content

Moisture content of horse gram was estimated by drying the samples in an oven at 105 °C till constant weight is obtained. It can also be done by digital moisture meter (AACC, 2000; Method No. 44-15A) [1].

Total ash

Ash was estimated by direct incineration of sample; igniting it in a Muffle Furnace at 550 °C till greyish white residue (AACC, 2000; Method No. 08-01) [1].

Protein

Protein content was determined by using Kjeldhal Apparatus as described in (AACC, 2000; Method No. 46-30) [1].

Total fat

Total fat content was determined using hexane as a solvent in Soxhlet apparatus as per the procedure given in (AACC, 2000; Method No. 30-25) [1].

Crude fiber

The fiber content was estimated by acid alkali method as suggested by (Chopra and Kanwar, 1978) [3].

Mineral contents

The sample were analysed for its mineral profile following (AACC, 2000) [1].

Result and Discussion

Nutritional composition of horse gram.

Data pertaining to various chemical properties like moisture, fat, carbohydrates, protein, ash, and crude fiber were investigated and results obtained are depicted in Table 1

Table 1: Chemical composition of horse gram

| Chemical Parameters | Mean Value* |
|---------------------|-------------|
| Moisture (%) | 8.05±0.6 |
| Total Fat (%) | 0.45±0.02 |
| Total carbohydrates | 58.2±0.16 |
| Total Protein (%) | 21.87±1.07 |
| Ash | 3.91±0.10 |
| Crude Fiber | 4.5±0.04 |

*Each value represents the average of three determinations

The data in the above table showed that the moisture content 8.05 per cent, fat 0.45 per cent carbohydrate 58.2 per cent, protein 21.87, ash 3.91 and crude fiber 4.5 respectively. Similar results were obtained by (Shivanna and Venkateswaran, 2016) [8], (A. Bhartiya *et al.*, 2015) [2] and (Marimuthu and Krishnamoorthi, 2013) [5].

Mineral composition of horse gram

The results given with respect to various minerals such as Ca, P, Na, K, Mg, Fe, Zn and Cu were determined and accordingly results presented in Table 2.

Table 2: Mineral content in horse gram

| Minerals | Average value (mg/100g) |
|------------|-------------------------|
| Calcium | 239 |
| Phosphorus | 321 |
| Sodium | 11.5 |
| Magnesium | 156 |
| Potassium | 762 |
| Iron | 7.54 |
| Zinc | 1.966 |
| Copper | 0.828 |

*Each value is an average of three determinations

The table 2 showed that the potassium content of horse gram was found to be highest 762 mg than the rest of other minerals, phosphorus 321 and calcium content 239 mg/100g and sodium 11.5mg/100g. The study showed that horse gram was good sources of potassium, phosphorous and calcium. However, differences in their mineral availability for absorption were observed and may be due to its mineral content and/or mineral-mineral interaction (Shivanna and Venkateswaran, 2016) [8] and (Bhartiya *et al.*, 2015) [2].

Conclusion

After critical assessment of nutritional and therapeutic aspect of horse gram, it can now be concluded that-it is a rich source of nutrient and antinutrient content. The nutritional value of horse gram is comparable with other pulse crop. Horse gram has high levels of antioxidant and radical scavenging activities in addition to their traditional role of providing proteins and carbohydrates. It has rich source of various natural bioactive substances such as phytic acid, fiber, phenolic acid etc. These bioactive substances have immense potential for curing varieties of diseases such as common cold, throat infection, fever, urinary stones, asthma, bronchitis, leukoderma, etc. The health benefits of horse gram are being recognized in the western world recently, but have been known for its ability to prevent and cure various diseases by Indian *Ayurvedic* system since centuries.

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