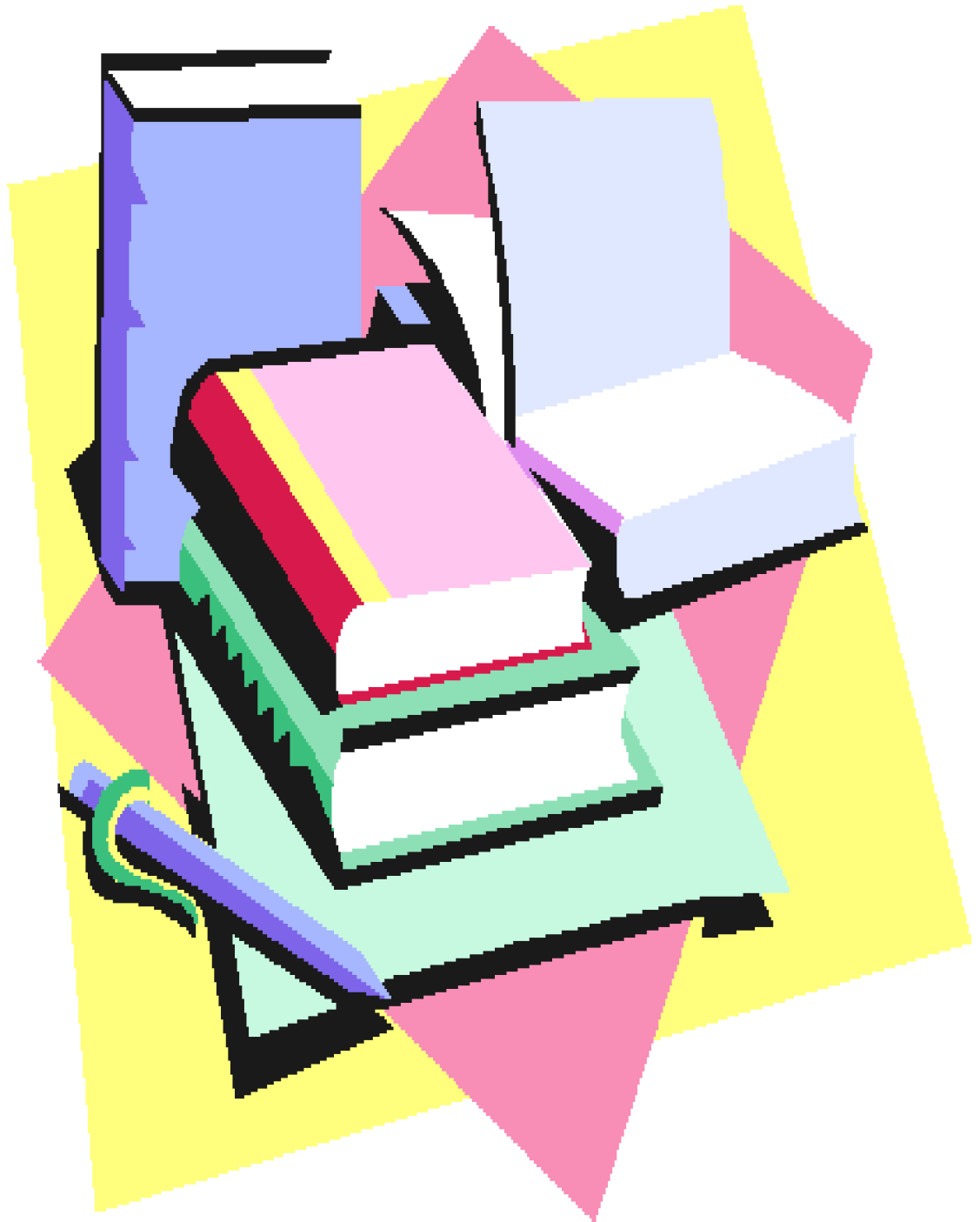

Chapter 1

Introduction



Though food patterns evolved taking their own time, mostly by trial and error, yet survival and thriving of human species for thousands of years point towards their adequacy. Modern innovation resulting from technology and urbanization has been causing a change in food patterns and, more often than not, changes have been lopsided, one way or the other, towards excess or insufficiency. Primitive human seemed to have instinctively formed dietary habits but its modern counterpart has fallen for artificial tastes of fast foods and is too far removed from nature to acquire *natural tastes* that are, conducive for purposeful nutrition. Looking into the natural, a plethora of nutrients are present encased in underutilized or non conventional food stuffs having the potential to cause 40% reduction in food cost and as much or more health benefits (Shah and Muller, 1983). Thus justification for increasing effective utilization of non conventional food stuffs lies in the nourishing ability they have and reduction in food cost they can bring about.

The production and consumption of neglected and underutilized species foster higher incomes, better nutritional security and preserve culinary and cultural traditions of indigenous communities. Moreover, these crops are often better adapted to grow in marginal areas, with lower need for irrigation, pesticides and fertilizers. In many instances, these species are the only crops that can cope with harsh environments, ill suited for other crops. The erosion of these species can have immediate consequences for the nutritional status and food security of the poor. New technologies can be harnessed to play their part in the processing and utilization of underutilized crops. Ultimately, we have to recognize that underutilized crops present their own range of problems and opportunities. Developing an agenda specific to these crops, must be recognized as an important and continuing need.

Horse gram (*Macrotyloma uniflorum*), commonly known as *kulthi* in India, is one such cheap and under explored legume crop rich in protein (22%) with high content of lysine, an essential amino acid (Prakash et al, 2008; Sudha et al, 1995; Kadam and Salunkhe, 1985; Virk et al, 2006). It is also rich in calcium (289mg %), iron, phosphorus, molybdenum and vitamins such as carotenes, thiamine, riboflavin, niacin and L-ascorbic acid (Sodani et al, 2004). Regarding nutritional and health promoting role of horse gram, there is paucity of scientific information requiring exploration employing research studies. Horse gram is famous for its medicinal uses because different parts of plants are used for the treatment of heart conditions, kidney stones, asthma, bronchitis, and leucoderma (Ghani, 2003).

Horse gram is also useful in anuria and amenorrhoea; conditions related with urinary and menstruation irregularities (NIIR, 2003). A few patients with ascites and edema of legs have also been known to be treated with aqueous extract of horse gram seeds (Kapoor, 2001). Presence of vitamin A in the green pod makes them a valuable diet for children; green leaves may also be used to make up for in vitamin C deficiency, due to the presence of vitamin C and calcium in them. The seeds contain several common phytosterols (books.google.co.in/books?id=gMwLwbUwtfkC&dq=C.P+Khare). The seeds are astringent to the bowels and are antipyretic, diuretic, antihelminthic, emmenagogue, appetizers, and lithotriptic. Indeed, horse gram could play a role as an antioxidant (Reddy et al, 2005)

becomes evident from the fact that when this plant was exposed to toxic levels of lead, several of its enzymes played a pivotal role against oxidative injury. Horse gram thus acts as a nutraceutical.

The fact that horse gram has been used as a medicine in India in the system of ayurveda becomes clear from the following verse given in an ayurvedic treatise:

कुलत्थिका कुलत्थश्च कथ्यन्ते तदगुणा अथ । ।
कुलत्थः कटुकः पाके कषायाः पित्तरक्तकृत् ।
लघुविदाही वीर्यौवण श्वासकासकफनिलान् । ।
हन्ति हिक्का · श्मरीशुक्रदाहानाहान् सपीनसान् ।
स्वेदसंग्राहको मेदोज्वरक्किमिहरः सरः । ।

(Misra & Vaisya, 1969)

Ancient wisdom in the above verse points towards multipurpose action of horse gram ranging from curing cough, cold, fever, and breathing trouble to enhancing virility and seminal strength.

The nutritive value of the horse gram is similar to that of other important legumes, but due to its poor cooking quality, strong flavor and higher levels of antinutritional substances like protease inhibitors, hemagglutinins, tannins, flatulence causing factors etc, they are not popular (Ghorpade et al, 1986; Kadam et al 1981).

As for processing of horse gram is concerned, germination is a simple method of food processing that results in an increased nutritive value. It decreases the phytate phosphorus level and increases the availability of iron and calcium. Though the presence of anti-nutritional factors of horse gram is a matter of concern (Sudha et al, 1995) yet the benefit of grain-based foods lies in the significant presence of antioxidants known as polyphenols, some of which were heither to considered antinutrients. Antioxidant activity of horse gram is a result of phenolic acids, especially caffeic and *p* – coumaric acid contents. Dietary polyphenols such as phenolic acids are considered to be powerful antioxidants. Their antioxidant activity is much higher *in vitro* than that of well- known vitamin antioxidants (Tsao and Deng, 2004). Antioxidant activity is, however, only one of the many mechanisms through which polyphenols exert their action. Polyphenols have also been reported and demonstrated to exert antimicrobial (Taguri et al, 2006; Rauha et al, 2000), antiviral (Perez, 2003), antimutagenic (Lairon and Amiot, 1999), anticarcinogenic (Aaby et al, 2004), anti-inflammatory (DosSantos et al, 2006; Parr and Bolwell, 2000), antiproliferative and vasodilatory actions (Lule and Xia, 2005).

It is one of the cheapest among Indian pulses and due to lack of awareness is invariably employed as food for horses and cattles. Food product development could be carried out by improving on popular horse gram recipes after household processing with the aim to increase its palatability, cooking and nutritional qualities as well as nutrient mobilization. During processing, that involves different treatments such as soaking, blanching, roasting, and germination, the variation in the activity of various enzymes too need to be focused upon. These changes affect biochemical constituents and

nutrient mobilization by compositional change following the breakdown of other constituents. As horse gram has a potential for curing a plethora of diseases as per ayurveda; soaked, germinated and blanched horse gram seeds can be used as *salad* ingredients with other vegetables including green leafy vegetables and fruits. Sumathi in 1995, found that amylase activity increased on progressive germination in all legumes, the increase being particularly high for green gram, horse gram, moth bean and black gram. Thus studies can also be planned on exploration of Amylase Rich Food (ARF) from horse gram. As it is well known that in ARF, amylase activity increases and the α - amylase cleaves the long carbohydrate chains into short dextrans. This remarkable property of ARF is used for the preparation of food with low viscosity and high energy to meet the high nutrient requirement of infants, children and people recovering from diseases (Srilakshmi, 2006). Anisha and Prema (2008), investigated that large scale production of horse gram flour after appropriate processing will be free of flatulence caused by oligosaccharides. For improving protein quality, cereal and pulse combination strategies need to be applied to innovatively develop different recipes using horse gram and cereal combinations. Horse gram is nutritionally good foodstuff for protein, calcium, and iron supply in the diet (Sodani et al, 2004; Gopalan et al, 1989). When diets are planned in keeping with children's RDA for protein, calcium, iron and, it can play a vital role. Protein is needed for tissue replacement and growth. Calcium is important for adequate mineralization and maintenance of growing bone in children. Likewise, iron is important for prevention and cure from high risk iron deficiency anaemia especially for older infants (Mahan and Stump, 2000). So development of eye appealing, handy and nutritionally rich supplementary food, for children using horse gram after adequate processing can prove beneficial.

Keeping in view the nutritional and therapeutic significance of horse gram along with their abundance and availability, this endeavor has been planned. It has been aimed at developing formulations by incorporating horse gram in raw and processed forms, to make low cost protein rich food products for vulnerable sections of the society, as well as for various diseases conditions. However, this all important exercise in product development was undertaken in the second phase of the study after validating the proximate principles, minerals, vitamin C, anti-nutritional factors, antioxidant potential, enzyme activities and observing the effect of different processing methods on them, in the first phase of the study. Food product development incorporating horse gram in raw and processed forms at various levels for different age groups as well as for various disease conditions along with subsequent sensory evaluation exercise has been meant to bring deliverable outcome from this study. In all, the study endeavor has the following objectives-

- To validate and re-lay the nutrient and antinutrient profile of horse gram.
 - To assess the enzyme activity changes during various stages of germination and harness the optimally germinated version for nutrient utilization and application.
 - To explore the therapeutic potential of horse gram by building on ancient ayurvedic wisdom and present phytochemical research.
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- To improvise household based processing methods to improve upon the acceptability characteristic of horse gram for nutritionally augmented and health promoting food product development.

The given study, contemplated, planned and executed in the true spirit of an organized research work is expected to broaden the horizons of knowledge by promoting the application of this nonconventional, marginalized food stuff with assuring nourishing and health enhancing potential. This promising role of horse gram can help to improve nutrition and to reduce the onset of various diseases linked to poor diet quality and other factors. This research could identify additional nutrition formats that may be equally or more effective at conveying nutrition information and social marketing initiatives.