

Medicinal Role of Mung Bean Sprouts (*Vigna radiata*)

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Abstract: *Background:* Worldwide, more than 500, 000 plant species are there. Those maintain earth's environmental equilibrium, stability of ecosystem and also possess aesthetic and cultural importance, provide food, fodder, fuel, shelter, medicine, cosmetic and clothing. Specially, in Asian countries Mung Bean (*Vigna radiata*) is an important pulse used in therapeutics to improve health for long decades. It is an excellent source of carbohydrate, proteins, amino acids, lipids, vitamins, minerals, dietary fibres, along with some bioactive compounds like poly-phenols, -saccharides, peptides, phytochemicals etc. which promote good health. It is proved in various research works that mung bean can play a major role against hyperglycemia, hyperlipemia, hypertension, tumour, cancer, heat stroke, immune suppression, inflammatory diseases, melanogenesis, ROS or RNS triggered diseases, sepsis etc. and it also acts as hepatoprotective, antioxidant, antidiabetic, antimicrobial, antimutagenic and immunomodulatory activities. This study aimed on preparation of aqueous extracts of mung bean sprouts and insight of bioactive compounds, nutritional compositions, phytochemical analysis, health benefits of mung bean sprouts along with the evaluation of future perspective and relevance. *Objectives:* To know the extraction methods of mung bean sprouts and comparative analysis of nutritional compositions, phytochemical analysis, health benefits of mung bean sprouts.

Keywords: Mung Bean Sprouts, Legume, Bioactive Compounds, Nutritional Compositions, Phytochemicals, Health Benefits

1. Introduction

Globally among 500, 000 plant species, Mung Bean (*Vigna radiata* L.; Family: Fabaceae), also known as Green Gram or Moong Bean has some potential health benefits [1]. Indian farmers have been widely cultivating Mung beans since 3500 years and consumed as traditional food items. Mainly due to some beneficial characteristics like short growth cycle (75-90 days), low-input crops, drought-tolerant, heat-tolerant (35°C), wider adaptability in almost all types of soil, it is cultivated in Asian countries (China, India, Bangladesh, Pakistan, and some Southeast Asian countries) well as in dry regions of southern Europe and warmer parts of Canada and the United States [2]. This *Vigna radiata* species contains nutrients, including protein, dietary fibre, minerals, vitamins, and significant amounts of bioactive compounds [3]. Furthermore, Mung Bean is easily digestible, low-cost, affordable vegetable protein source in our daily diet [4, 5]. As name suggests, *Vigna* genus derived by an Italian Botanist of 17th century, Domenico Vigna. It includes around 150 species [6]. In India, China, Bangladesh, Philippines, Thailand, South East Asia, and Western countries, Mung Bean and Sprouts are consumed as fresh salad or vegetable [7]. In 'Meteria Medica', *Ben-Cao-Gang-Mu*, a well-known Chinese Pharmacopoeia, it has recorded that it can be utilised as traditional Chinese Medicine for its detoxification activities, recuperation of mentality, ability to alleviate heat stroke, reducing summer swelling, regulation of GI problems, acne, eczema, dermatitis, itching etc. [8, 9] Mung Bean seeds and Sprouts are illustrated in Fig. 1.



Figure 1: Mung Bean Seeds, Mung Bean Sprouts and Mung Bean Sprouted Seeds

In some recent study, it is proved in various research works that mung bean can play a major role against hyperglycemia, hyperlipemia, hypertension, tumour, cancer, heat stroke, immune suppression, inflammatory diseases, melanogenesis, ROS or RNS triggered diseases, sepsis etc. and it also acts as hepatoprotective, antioxidant, antidiabetic, antimicrobial, antimutagenic and immunomodulatory activities. Mung bean and sprouts produce lower calories compared to other cereals which are advantageous for obesity and diabetic individuals [10], its seeds are used for paralysis, fever, cough, rheumatism and neuro-diseases and roots are used in bone ache healing [11]. Analytical studies have shown that a variety of nutrients and metabolites in mung beans are significantly improved during germination [12-19]. Furthermore, these sprouts contain more potential antioxidant substances such as polyphenols when compared to the raw seeds [20-22].

Nutritional Compositions

Using gas-liquid chromatography (GC)/ mass spectrometry (MS), it is reported Mung Bean and sprouts contain various nutraceutical including water (90.4g), carbohydrates (hexasaccharide, raffinose, etc.; 5.94g in sprouted), proteins (globulins (63%), albumins (12%), glutelins (21%), prolamins (1%)), amino acids (tryptophan: 0.037g, threonine: 0.078g, isoleucine: 0.132g, leucine: 0.175g, glycine: 0.063g etc.), lipids (SFA (71%), MUFA (18%), PUFA (11%)), vitamins (ascorbic acid: 13.2mg, thiamine: 0.084mg, Vit. B-6: 0.088mg, -A: 21IU, -E: 0.1 mg, -K: 33µg etc.), minerals (Mg, P, Fe, K, Cu, Zn, Ca, Mn, Na, Se etc.), total dietary fibre (1.8g), organic acids (oxalic, malic, citric, fumaric etc.) [23, 24, 25]. These compounds are functional food ingredients having biological activities; anti-oxidant, -inflammatory, -diabetic, -viral, -bacterial, -fungal, -cancer and -tumour activity, hepatoprotective, and other detoxification activities etc.

Bioactive Compounds**Polyphenols**

The Mung Bean is a rich source of Polyphenols. The major phenolic constituents in the mung bean are phenolic acids (1.81-5.97 mg rutin equivalent/g), flavonoids (1.49-1.78 mg catechin equivalent/g), and tannins (1.00-5.75 mg/g) [26-29]. Flavonoids are the most common secondary metabolites in the mung bean. Five subclasses of flavonoids, are flavones, flavonols, isoflavonoids, flavanols, and anthocyanins found in mung bean.

Polysaccharides

In Mung Bean Polysaccharides like Hemicellulose-A, Hemicellulose-B containing acidic Arabinogalactan (AGP-2), terminal Arabinose are responsible for antioxidant, immunomodulatory activities and also to activate macrophages [30-35].

Peptides:

Therefore dietary nutrients, protein from pulses like mung bean releases peptides which may exhibit bioactive properties. Un-hydrolysed mung bean peptides have shown Angiotensin I-converting enzyme (ACE) inhibitory effect which is also important for current COVID-19 outbreak, along with anti -cancer, -oxidant effects [36, 37].

Health Benefits:

Based on high constituents and efficacy of bioactive compounds mung bean plays an important role in health benefits.

Antioxidant activity:

Mung bean seeds, sprouts contain a large amount of macro and micro nutrients which exerts antioxidant activities. Specially, phenolic compounds and vitamins are the major antioxidants. Both compounds can restrain free radical generation by chelating metal ions or inhibiting key enzymes (protein kinase, xanthine oxidase, GSH, lipoxygenase, cyclooxygenase, NADH oxidase and GST) [38-40]. Mungbean sprouts have higher antioxidant potential than raw seeds.

Antidiabetic activity:

The consumption of mung bean has been reported as a potential antidiabetic agent. An experiment have shown the effect of fermented and non-fermented mung bean extracts on normoglycemic, glucose-induced hyperglycemic and alloxan-induced hyperglycemic effects, caused no hypoglycemic effect and lowered blood sugar levels [41]. Another experimental study also revealed that mung beansprout (2 g/kg) and seed coat extracts (3 g/kg) possessed antidiabetic effects [42].

Anti -hyperlipidemic and -hypertensive activities:

Mung bean with dietary fibres induced satiety to reduce cholesterol level. Its sprouts have a lipid modulatory effect. In a study, rabbits with hyperlipidemia were fed a 70% mung bean mixed meal and sprout powder to reduce cholesterol [43]. Additionally, in a recent study, normal mice and rats were fed mung bean extracts for 7 days, and total cholesterol level was decreased [44]. In another study has shown high doses (600 mg peptide/kg body weight) of

raw sprout extracts, dried sprout extracts and enzyme digested sprout extracts reduced systolic blood pressure (SBP) in rats after administration for different time intervals [45].

Antimicrobial activity:

Enzymes, peptides and polyphenols extracted from mung bean shown positive antimicrobial (agar diffusion method) as well as antifungal (crescents method) effects [46, 47].

Anti-inflammatory activity:

Mung beans have been consumed in several ways to treat heat stroke connected with thirst, irritation and high body temperature, detoxification, and these health promoting effects of mung bean seeds and sprouts are believed for inflammatory response in Asian countries [48]. Mung bean seed and sprout extracts may reduce lipopolysaccharide-stimulated peritoneal macrophages and inflammation-related parameters (TNF- α , IL-1 β , IL-6, nitric oxide synthase, COX-2, and NF- κ B) and alleviate the symptoms of obesity, colitis and colon inflammation [49].

Anti -tumour and -cancer activities:

Mung beans extracts are also proved for Anti -tumour and -cancer activities. Nucleases derived from mung bean are effective against melanoma tumours [50]. Mung bean extracts are anti-proliferative against DU145, SK-OV-3, MCF-7 and HL-60 cancer cell lines [51].

Antisepsis activity:

The aqueous extract from mung bean coat (MBC) is protective against sepsis *in-vitro* and *-vivo*. It was found that MBC dose-dependently attenuated the LPS-induced release of HMGB1 and several chemokines in macrophage cultures, helpful for sepsis [52].

2. Methodology**Sample collection**

Green Moong Sprouts (*V. radiata*) was purchased from Spencer, Chinar Park, Kolkata.

Preparation of aqueous extract:

- Gently wash Mung Bean Sprout samples
- Solvent Extraction Method is followed after proper drying
- Samples are to be grinded and mixed up in motor pastel as soon as possible to prevent further oxidation
- For aqueous extraction, 50g fresh sprout paste is added in 200ml distilled water and wait for 24hrs. 48hrs. and 72hrs. of maceration (solvent + sample + room temperature incubation + 2 days)
- Gradually the extracts are to be filtrated using funnel filtration method with whatman filter-paper
- Filtrates are allowed to stand overnight to get better result and store in 4°C fridge temperature
- Now these extracts can be used for further assays

3. Main Findings

Preparation of Mung Sprout extract:



Figure 2: How Mung Bean Sprouts are macerated to get filtrated crude extract

By following solvent extraction method, 200ml aqueous extract was prepared using 50g fresh green mung sprout. Therefore it was filtrated and finally a light yellowish crude extract (rich in phytochemicals, phytonutrients) was collected and stored in 4°C fridge temperature for future use.

Online Survey Work:

In my online survey work based on the necessities of mung bean and mung bean sprouts (<https://forms.gle/QD5CrivHzPpYGGHk6>), around 52 responses were recorded in Google form and here the graphical representations revealed that more than 96.2% were aware about the necessities of mung bean and mung bean sprouts in daily diet due to its natural defencing characteristics such as antioxidant, antimicrobial, antifungal, anti-inflammatory, anti-cancerous etc. along with high proteinaceous, nutritional, bioactive compounds including Vitamin A, B, K as well as essential minerals such as Fe, Ca, Mg, P, Zn, Mn, K. It was recorded as immunity booster as well. From this survey it was proved that 92.3% consumes mung bean or its sprouts regularly. Even 65.4% replied regarding its personal care and cosmetic uses due to its skin nourishing, glowing, acne, pigmentation, dark spot removing and anti-ageing properties and it could be used as natural face -mask, -pack, -scrub, -serum etc.

4. Conclusion

In conclusion, the synthesised yellowish crude aqueous extract of *Vigna radiata* sprout is highly effective as antioxidant, anti-inflammatory, antifungal, antimicrobial, antidiabetic, anti-tumour, anticancer agents etc. Mung beans have been consumed in regular diet worldwide due to its high nutritional value (protein, vitamins, phytonutrients and micro nutrients).

5. Future perspectives:

Mung bean peptides have shown Anti-inflammatory as well as Angiotensin I-converting enzyme (ACE) inhibitory effect which is also important for current COVID-19 outbreak as ACE2 acts as protein receptor on many cell types for SARS-CoV-2 to infect target cell. Thus future study is required to use as therapeutics for COVID-19. Therefore, future far-reaching clinical studies are required to warrant the therapeutic convenience of bioactive rich mung bean.

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