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# An antioxidant activity of methanol and acidic methanol extracts of Mungbean *(Phaseolus aureus L.)* cultivars differing in seed color.

**[1]*Junna Lalitha, [1]Muhammed Tajoddin, [2]Manohar Shinde.**

[1]Department of Biochemistry, Gulbarga University, Gulbarga-585106, Karnataka, India, [2]Department of Biochemistry, Tumkur University, Tumkur-572103, Karnataka, India.

**Abstract**

Ten samples of mung bean (*Phaseolus aureus* L.) cultivars differing in seed coat color were analyzed for their polyphenolic content and *in vitro* antioxidant power. The total antioxidant power in mung bean cultivars was found to be ranged between 106.80 to 271.11 mg equivalents of Vitamin C/g. The average total antioxidant power as well as polyphenolic content of yellow mung bean cultivars was more than that of the green cultivars. The acidic methanol extract constitute about 75% of total polyphenols and total antioxidant power. The total phenolic contents correlated directly with characteristic antioxidant activities. A positive correlation was observed between polyphenolic content and antioxidant activities of tested cultivars. Mung beans are fair sources of polyphenols responsible for antioxidant activity, and thus having great potential as a source of natural antioxidants in human nutrition.

**Key Words**

Mung bean, polyphenols, methanol extract, acidic methanol extract, antioxidant power.

## Introduction

Legumes are good and relatively cheaper sources of proteins and carbohydrates for developing countries including India. Recently dry bean polyphenols have received considerable attention largely as a result of their possible influence on the nutritional and aesthetic qualities of foods, biochemical and physiological functions and their pharmacological and toxicological implications. Most legumes are known to contain appreciable levels of polyphenolic substances broadly referred to as tannins. These may be divided in to two main groups, Hydrolysable (HTs) and Condensed tannins (CTs)[1]. HTs can be easily extracted with methanol or acetone, whilst CTs can be readily extracted by acidified methanol[2]. Many studies have demonstrated detrimental effects of polyphenols in animals including decreased digestibility of dietary proteins and decreased utilization of minerals in food[3], but are now attracting attention because of their widespread beneficial effects on human health. Flavonoids, an important class of polyphenol compounds in food have numerous biological and pharmacological

***Corresponding Author:**
jlshinde@rediffmail.com

properties including antioxidative, anticarcinogenic and antiarteriosclerotic activities[4]. Flavonoids and phenolic acids are considerably more potent antioxidants than vitamin C and vitamin E[5, 6]. A high correlation between the total antioxidant activity of some fruits, floral honey and their phenolic contents has been reported[7-9]. Mung bean (*Phaseolus aureus* L.) is most important legume due to its high carbohydrate, protein and minerals. Its protein quality is similar to or better than other legumes such as chickpea, black gram, peas, pigeon pea etc.[10, 11]. India is the major pulse producing country and among various pulses, mung bean stands third[12] and it is the principal crop from which edible bean sprouts, noodles and weaning foods are prepared. The polyphenol content of mung bean cultivars differ in seed coat color was reported earlier[13]. The systematic investigation on antioxidant power in polyphenolic extract of mung bean cultivars differing in seed coat color is lacking, to the best of our knowledge. In this context, the study was carried out to evaluate antioxidant activities in polyphenolic extracts of mung bean cultivars.

## Materials and Methods

The mung bean cultivars, GMBLN-2, PS-16, Pusabaisaki, TAP-7, Vaibhav, Hum-1 and China mung were procured from the Agriculture Research Station, Aland Road, Gulbarga, India. Other three yellow cultivars were procured from farmers and designated as ALM-1, ALM-2, and ALM-3 respectively. The samples were cleaned and stored in the laboratory at 4 $^{o}$C. All chemicals used were of analytical grade.

### Extraction and determination of Polyphenols

Clean, whole dry seeds were finely powdered to pass through a 0.6mm mesh screen, and one gram defatted meal was extracted twice with 10ml of methanol each time at 25±2 $^{o}$C for 20 minutes. The residue was re-extracted twice with 10ml of methanol containing 1% HCl[2]. Methanol and acidic methanol extracts were analyzed for polyphenols content according to the method of Burns[14]. The concentration of polyphenols was expressed in milligram of gallic acid equivalents (GAE) per 100 gm of sample.

### Determination of the antioxidant power (AP)

The antioxidant power was determined by measuring the release of thiobarbituric acid reactive substance (TBARS) in terms of standard ascorbic acid equivalent, as described by Ohkawa et al[15]. The results are expressed as mg equivalent of ascorbic acid per gram of sample. The polyphenolic content verses antioxidant power values were plotted to analyse the relatedness.

### Statistical Analysis

The values were expressed in mean ± standard deviation (SD). Statistical analysis were performed by an analysis of variance (ANOVA) using the SPSS data analysis tool, Version 14.

**Results and Discussion**

The mung beans are found to be fair sources of polyphenols and the average polyphenolic content of yellow mung bean cultivars was more than that of the green cultivars[13]. The mung bean contains variety of polyphenols, which can be selectively extracted using various organic solvent systems. Most of the polyphenols such as condensed tannins can not be easily extracted by methanol or acetone but easily extracted with acidic methanol[2]. About only 25% of the total polyphenols were extracted with methanol and total antioxidant power also found to be about 25% in methanol extract whilst, remaining 75% of polyphenols were extracted with acidic methanol and antioxidant power also found to be 75% in acidic methanol extract (Table 1). The total antioxidant power in mung bean cultivars was found to be ranged between 106 to 271 mg equivalents of Vitamin C/g. The highest antioxidant power was found in China mung (271 mg/g) and lowest was in Pusabaisaki (106 mg/g). The average antioxidant power of yellow mung bean cultivars was more (240 mg/g) than that of green cultivars (195 mg/g). The antioxidant power in methanol and acidic methanol extracts was found to be ranged between from 19.40 to 89.62 and 87.40 to 181.48 respectively. The ratio index of antioxidant power and polyphenols in methanol extracts of ALM-3, GMBLN-2, TAP-7, Vaibhav and China mung was greater than that of acidic methanol extracts. Whereas the ratio index of total antioxidant power and total polyphenol content was higher in all three yellow cultivars ALM-1, 2 and 3 and three green cultivars; GMBLN-2, Vaibhav and China mung (Table 1). However, the total antioxidant power and total polyphenol content was found to be three times more in acidic methanol extract than that of methanol extract. These results are in agreement with the reports made by Stickland[16], Martin–Tanguy et al[17], who had observed condensed tannins (polyphenols) extracted by acidic methanol as major constituents of dry been polyphenols and potent antioxidants. A positive correlation was also found between antioxidant power and polyphenol content in methanol extracts ($r = 0.416$) and acidic methanol extracts ($r = 0.499$) (Fig. 1A & 1B), whereas, a high positive correlation ($r=0.891$) was found between total antioxidant power and total phenolic contents (Fig. 1C). The China mung cultivar showed highest total antioxidant power (271 mg/g) which had also contained highest total polyphenols (356 mg/100 g), whilst the Pusabaisaki showed less antioxidant power (106 mg/g) and had lowest polyphenols content (280 mg/100 g), emphasizing antioxidant activities of mung bean polyphenols.

The variations in the antioxidant capacities of mung bean cultivars were due to the quantitative and qualitative nature of their phenolic contents. Similar observations were made by other researchers, who found variations between different phenolics in terms of their antioxidant activities of food products[8], flavonoids[18] and germinated and cooked pulses[19]. In

present investigation, the mung bean cultivars which showed highest antioxidant power had also contained highest polyphenols. These findings are in agreement with the observations made by Guo et al[7], Velioglu et al[8], Aljadi and Kamaruddin[9], Wang et al[20] and Emine and Salih[21] who found a high correlation between the total antioxidant capacities of some fruits, floral honeys and their total phenolic contents. The polyphenols are the compounds responsible for the antioxidant activity of mung bean but obviously other factors are also involved. These might be different phenolic compositions or the presence of non-phenolic antioxidants such as ascorbate, α-tocopherol and β-carotene.

## Conclusion

The mung beans are fair sources of polyphenols, thus having the antioxidant capacities. The higher antioxidant activity was found in acidic methanol extracts due to more extractable polyphenols. A positive correlation was observed between polyphenolic content and antioxidant activities of tested cultivars. The phenolics are the compounds responsible for the antioxidant activity of mung bean but obviously other factors are also involved. The results obtained in the antioxidant studies clearly demonstrates that, the cultivars that showed higher polyphenolic contents also showed higher antioxidant capacity and hence the yellow cultivars with high polypenols and antioxidant characters can be used for the preparation of bean sprouts, noodles and weaning foods for children, lactating mothers and old age peoples.

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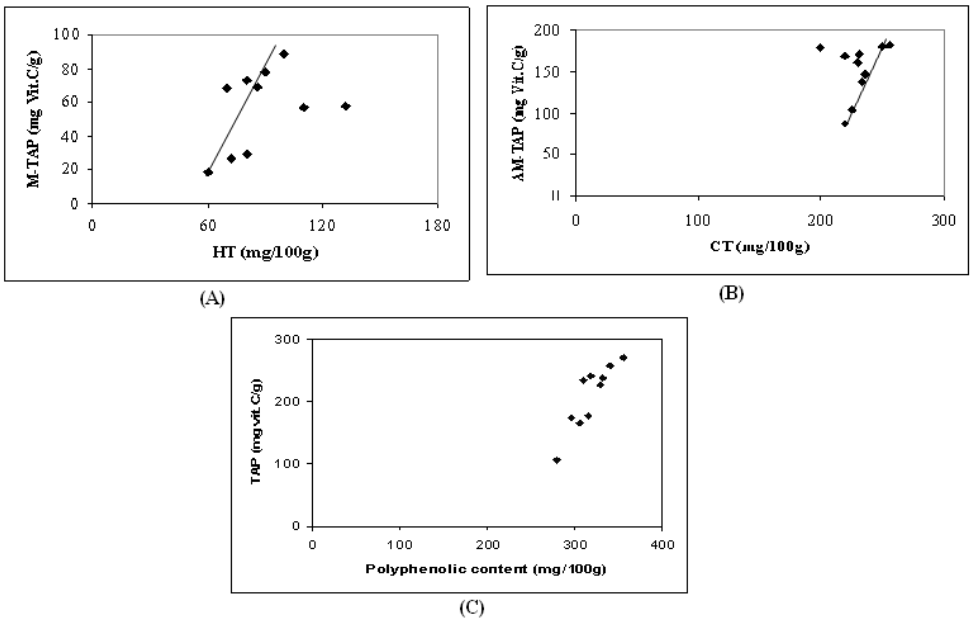


**Figure 1:** Correlation between Antioxidant Power and polyphenol content of methanolic extract **(A)**, acidic methanol extract **(B)** and total antioxidant power and total polyphenolic content **(C).**

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