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Proximate composition and antioxidant activity of Mothbean (*Vigna aconitifolia* (Jacq.) Marechal) varieties

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Abstract
Eleven mothbean varieties including both pre-released and released varieties were procured from AICRP for dry land agriculture, Regional Agricultural Research Station, Vijayapur, University of Agricultural Sciences, Dharwad and they were analyzed for proximate composition, antioxidant activity and total polyphenol content. RMB-141 had highest crude protein, KBMB-1 had highest crude fiber, MBS-27 had higher moisture content, BGMBG-10 had higher fat content, RMB-101 had highest carbohydrate content, CGM-18 had highest fat content. There was significant difference ($p \leq 0.01$) between the two groups with regard to antioxidant activity and total phenolic content. Antioxidant activity ranged from 10.57-13.44 percent. Highest antioxidant activity was observed in the variety RMB-408 (13.44%). The total polyphenol content varied from 2.28-2.79 mgGAE/g where RMB-408 had highest content (2.79 mgGAE/g). The variation in the proximate composition between the varieties could be from location, varietal differences, soil and agroclimatic condition. The reason attributed to higher phenolic content is may be due to dark color of the seed and phenolic compounds are concentrated in the seed coat region and this is further related to higher antioxidant activity.

Keywords: Proximate composition, antioxidant activity, Mothbean, *Vigna aconitifolia* (Jacq.), Marechal

Introduction

Food legumes are crops of the family *Leguminosae* also called *Fabacae*. Grain legumes used in combination with cereals are grown in both tropical and temperate regions of the world viz., Africa, Asia, West Indies and Latin America. India is the largest consumer and importer of pulses in the world and they are consumed regularly in every household at least with one meal. They enhance the protein content of cereal-based diets and improve the nutritional status of the cereal-based diets. Legumes not only add variety to human diet but also serve as an economical source of supplementary proteins for a large population in developing countries like India where majority of population are vegetarian. Indian diet is largely vegetarian due to religious and ethical values and pulses are major source to meet this requirement. Pulses play a significant role in mitigating protein malnutrition of millions of poor vegetarians in tropical and semi tropical regions of world. Hence legumes are considered as "poor man's meat".

Legumes apart from being an important source of macro nutrients (carbohydrates, protein, fiber) and micronutrients (calcium, magnesium, zinc, iron, potassium, phosphorous), the health benefits of consuming legumes are also related to the amount of dietary fiber and polyphenols present in legumes. A number of epidemiological studies have correlated the consumption of legumes with high phenolic content to the reduced incidence of diseases such as cancer, ageing, diabetes, and cardiovascular disease. The dominant phenolic compounds present in leguminous seeds are flavonoids, phenolic acids, and procyanidin. Apart from this, they are also the important source of antioxidants, where the antioxidants exhibit the wide range of physiological properties such as anti-allergenic, anti-inflammatory, anti-microbial, cardio protective and vasodilatory effect.

Mothbean (*Vigna aconitifolia* (Jacq.) Marechal) is one of the primitive pulses which is consumed throughout India. Mothbean is recognized for its twin tolerance to drought and heat. It is, therefore, the ultimate choice of the marginal and sub-marginal farmers for realization of sustained production under he harsh agro-climatic situations. Mothbean is widely grown in arid and sandy tracts of Rajasthan, India's driest state. Antioxidants are an important part of defense system of human body and help to cope up with oxidative stress caused by reactive oxygen species. Now a day's people are more concerned about antioxidant property of the

particular food. It is mainly due to its protective action against harmful free radicals or the reactions that cause excessive oxidation and thus reducing the risk of coronary heart diseases and cancer. Thus helps in preventing oxidative damage of lipids and low-density lipoproteins. The antioxidants present in the food helps to inhibit lipid peroxidation and improve food quality and safety. Mothbean is said to have potential antioxidant activity and phenolic content but there are very few studies on antioxidant content of mothbean varieties.

Agricultural scientists and breeders are involved in development and release of new varieties having better nutritional value and having good antioxidant activity and it is a continuous process.

Hence, the present study was undertaken to assess the proximate composition, total polyphenol content and antioxidant activity of mothbean varieties with the following objectives

- ✓ To determine the proximate composition of mothbean varieties
- ✓ To assess the total polyphenol content and antioxidant activity of mothbean varieties

Materials and methods

Eleven mothbean varieties were procured from AICRP for dry land agriculture, Regional Agricultural Research Station, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka state in India. Among the eleven varieties, three were pre-released varieties (BGMBG-10, BGMB-11 and BGMB-14) and eight were released varieties (CZM-3, CGM-18, RMB-101, RMB-108, RMB-141, RMB-408, MBS-27, KBMB-1). For the preparation of composite sample, the seeds were finely ground in the mechanical grinder, mixed and finally stored in the air tight container.

Proximate composition of mothbean varieties was determined using standard AOAC method (Anon., 2005) [1]. Antioxidant activity was estimated using DPPH as the method given by Dorman *et al*., 2014 [2] and total polyphenol content was determined as the procedure given by Sadashivam and Manickam., 2008 [9] using gallic acid as a standard.

The results were statistically analyzed by one way ANOVA followed by independent t-test, using SPSS software.

Results and Discussion

Moisture, protein, fat, ash, crude fiber and total carbohydrate of mothbean varieties are presented in Table 1. There were significant differences observed in all proximate composition among the varieties ($p \leq 0.01$). Moisture content ranged between 7.17-8.46 g/100 g. MBS-27 had highest moisture content *i.e* 8.46 g/100 g followed by CZM-3 (8.2 g/100 g) and RMB-141 (8.09 g/100 g) and least was recorded in KBMB-1 (7.17 g/100 g). The fat content varied from 0.92-1.11 g/100 g. CGM-18 and BGMBG-10 had highest fat content (1.11 g/100 g) followed by MBS-27 (1.08 g/100 g) and RMB-101(1.07 g/100 g) and RMB-108 had least fat content (0.92 g/100 g).

Protein content ranged from 21.91-26.08 g/100 g. RMB-141 had the highest protein content (26.08 g/100 g) followed by KBMB-1 (25.87 g/100 g) and BGMB-14, RMB-108 (25.56 g/100 g). RMB-101 had least protein content (21.91 g/100 g). The crude fiber content ranged from 4.46-5.16 g/100 g. Highest was observed in KBMB-1 (5.16 g/100 g) followed by CGM-18 (5.11 g/100 g) and RMB-108 (5.08 g/100 g) and least content was observed in BGMB-14 (4.46 g/100 g).

The ash content ranged from 3.50-3.82 g/100 g. CGM-18 had the highest ash content (3.82 g/100 g) followed by MBS-27 (3.77 g/100 g) and KBMB-1 (3.75 g/100 g) and the least content was observed in BGMB-11 (3.50 g/100 g). The carbohydrate content varied from 55.07-60.53 g/100 g. Highest content of carbohydrate was observed in the variety RMB-101 (60.53 g/100 g) followed by RMB-408 (58.75 g/100 g) and BGMB-14 (57.92 g/100 g) and the least content was observed in the variety RMB-141 (55.07 g/100 g).Similar results were observed in the study conducted by Mankotia and Modgil (2003) [6]. Soris and Mohan (2011) [11] recorded slightly higher values for crude fat and ash content compared to present study. Gujral *et al.*, (2011) [3] recorded slightly higher value for fat content in mothbean seeds. Salve and Mehraifatema (2011) [10] recorded the similar values except for fat content where the values were slightly higher compared to present study. Table 2 depicts the comparison of proximate composition between pre-released and released mothbean varieties. There was no significant difference found in the proximate composition of pre-released and released varieties, pre-released varieties recorded higher mean values for fat, protein and carbohydrate content whereas released varieties recorded higher values for moisture, ash and crude fiber content. Variation in proximate composition is may be due to location, varietal differences, type of soil in which they are grown, climatic conditions and also depends on fertilizer treatment.

Table 3and Fig. 1 represents the antioxidant activity and total polyphenol content of mothbean varieties. Both antioxidant activity and total polyphenol content varied significantly among the varieties ($p \leq 0.01$). Antioxidant activity ranged from 10.57-13.44 percent. Highest antioxidant activity was observed in the variety RMB-408 (12.57%) followed by CGM-18 (13.39%) and RMB-101 (12.92%) and lowest content was observed in BGMB-11 (10.57%). The total polyphenol content varied from 2.28-2.79 mgGAE/g where RMB-408 had highest content (2.79 mgGAE/g) followed by CGM-18 (2.77 mgGAE/g) and RMB-101 (2.73 mgGAE/g) and BGMB-11 had least content of total polyphenol content (2.28 mgGAE/g).

Table 4 represents the comparison of antioxidant activity and total polyphenol content between pre-released and released varieties of mothbean. There was significant difference between the two groups ($p \leq 0.01$) with regard to both antioxidant activity and total polyphenol content. Released varieties had the higher content of both antioxidant activity and total polyphenol content compared to pre-released varieties.

Similar results were also reported by Perumal (2006) [7], Gujral *et al.* (2011) [3]. Kestwal *et al.* (2012) [5] and Ramesh and Swami (2016) reported that the total antioxidant activity of mothbean was 2656 µg percent of ascorbic acid. The reason attributed to higher phenolic content is may be due to dark color of the seed and phenolic compounds are concentrated in the seed coat region (Gujral *et al.* 2013) [4] and this is further related to higher antioxidant activity. Several studies (Gujral *et al.* 2011; Gujral *et al.* 2013) [3, 4] also support the present results *i.e* as phenolic content increased antioxidant activity also increased.

There was significant difference in all proximate composition, antioxidant activity and total polyphenol content among the varieties and no significant difference was found between pre-released and released varieties with regard to proximate composition. This indicates that pre-released varieties are on par with released varieties. However, significant difference

was found between pre-released and released varieties with regard to antioxidant activity and total polyphenol content. Released varieties registered higher values for both antioxidant activity and total polyphenol content compared to pre-released varieties.

Table 1: Proximate composition of mothbean varieties (g/100 g)

Varieties	Moisture	Fat	Crude protein	Ash	Crude fiber	Carbohydrate
Pre-released varieties						
BGMBG-10	7.64 ± 0.078	1.11 ± 0.175	24.86 ± 0.735	3.65 ± 0.070	4.92 ± 0.090	57.79 ± 0.647
BGMB-11	8.05 ± 0.198	1.04 ± 0.127	24.46 ± 0.472	3.50 ± 0.070	5.04 ± 0.081	57.89 ± 0.240
BGMB-14	7.97 ± 0.061	1.06 ± 0.098	25.56 ± 0.476	3.64 ± 0.066	4.46 ± 0.087	57.92 ± 0.530
Released varieties						
CZM-3	8.20 ± 0.065	0.95 ± 0.065	24.74 ± 0.255	3.63 ± 0.125	4.86 ± 0.050	57.59 ± 0.490
CGM-18	7.98 ± 0.046	1.11 ± 0.120	24.81 ± 0.310	3.82 ± 0.056	5.11 ± 0.075	57.14 ± 0.531
RMB-108	7.82 ± 0.119	0.92 ± 0.062	25.56 ± 0.476	3.62 ± 0.058	5.08 ± 0.100	57.0 ± 0.579
RMB-408	7.82 ± 0.070	1.02 ± 0.900	23.96 ± 0.160	3.53 ± 0.135	4.89 ± 0.083	58.75 ± 0.180
RMB-141	8.09 ± 0.147	1.00 ± 0.097	26.08 ± 0.809	3.69 ± 0.076	5.04 ± 0.107	55.07 ± 1.137
RMB-101	7.97 ± 0.087	1.07 ± 0.085	21.91 ± 0.243	3.62 ± 0.086	4.87 ± 0.155	60.53 ± 0.358
MBS-27	8.46 ± 0.047	1.08 ± 0.124	24.52 ± 0.524	3.77 ± 0.085	4.80 ± 0.010	57.36 ± 0.698
KBMB-1	7.17 ± 0.083	1.07 ± 0.105	25.87 ± 0.294	3.75 ± 0.065	5.16 ± 0.091	56.96 ± 0.257
Mean ± SD	7.92 ± 0.330	1.04 ± 0.109	24.85 ± 1.311	3.66 ± 0.118	4.93 ± 0.203	57.58 ± 1.367
S. Em. ±	0.058	0.063	0.274	0.048	0.052	0.332
C. D.	0.169**	0.185NS	0.805**	0.142**	0.151**	0.973**
F value	31.53	1.08	22.18	3.93	13.63	15.94

Note: Values are mean of three replications, S. Em.: Standard Error of Mean, C. D.: Critical Difference, **Significant @ 1%, NS-Non Significant

Table 2: Proximate composition (g/100 g) between pre-released and released mothbean varieties

Varieties	Moisture	Fat	Crude protein	Ash	Crude fiber	Carbohydrate
Pre-released varieties	7.89 ± 0.216	1.07 ± 0.122	24.96 ± 0.690	3.60 ± 0.095	4.80 ± 0.273	57.65 ± 0.517
Released varieties	7.94 ± 0.366	1.02 ± 0.104	24.81 ± 1.489	3.68 ± 0.119	4.97 ± 0.151	57.55 ± 1.58
t value	NS	NS	NS	NS	NS	NS

Note: Values are mean of three replications, NS-Non Significant

Table 3: Antioxidant activity and total polyphenol content of mothbean varieties

Varieties	Antioxidant activity (%)	Total polyphenol (mgGAE/g)
Pre-released varieties		
BGMBG-10	11.36 ± 0.15	2.47 ± 0.03
BGMB-11	10.57 ± 0.19	2.28 ± 0.02
BGMB-14	11.65 ± 0.21	2.52 ± 0.02
Released varieties		
CZM-3	12.55 ± 0.32	2.64 ± 0.03
CGM-18	13.39 ± 0.25	2.77 ± 0.02
RMB-108	12.57 ± 0.32	2.71 ± 0.08
RMB-408	13.44 ± 0.29	2.79 ± 0.03
RMB-141	11.24 ± 0.09	2.44 ± 0.04
RMB-101	12.92 ± 0.42	2.73 ± 0.08
MBS-27	12.66 ± 0.36	2.72 ± 0.10
KBMB-1	11.98 ± 0.49	2.55 ± 0.12
Mean ± SD	12.21 ± 0.93	2.60 ± 0.16
S. Em. ±	0.17	0.11
C. D.	0.51**	0.04**
F value	27.49	17.84

Note: Values are mean of three replications, S. Em.: Standard Error of Mean, C. D.: Critical Difference, **Significant @ 1%

Table 4: Antioxidant activity and total polyphenol content between pre-released and released mothbean varieties

Varieties	Antioxidant activity (%)	Total polyphenol (mgGAE/g)
Pre-released varieties	11.19 ± 0.50	2.43 ± 0.11
Released varieties	12.59 ± 0.74	2.66 ± 0.13
t value	6.14**	4.73**

Note: Values are mean of three replications, **Significant @ 1%

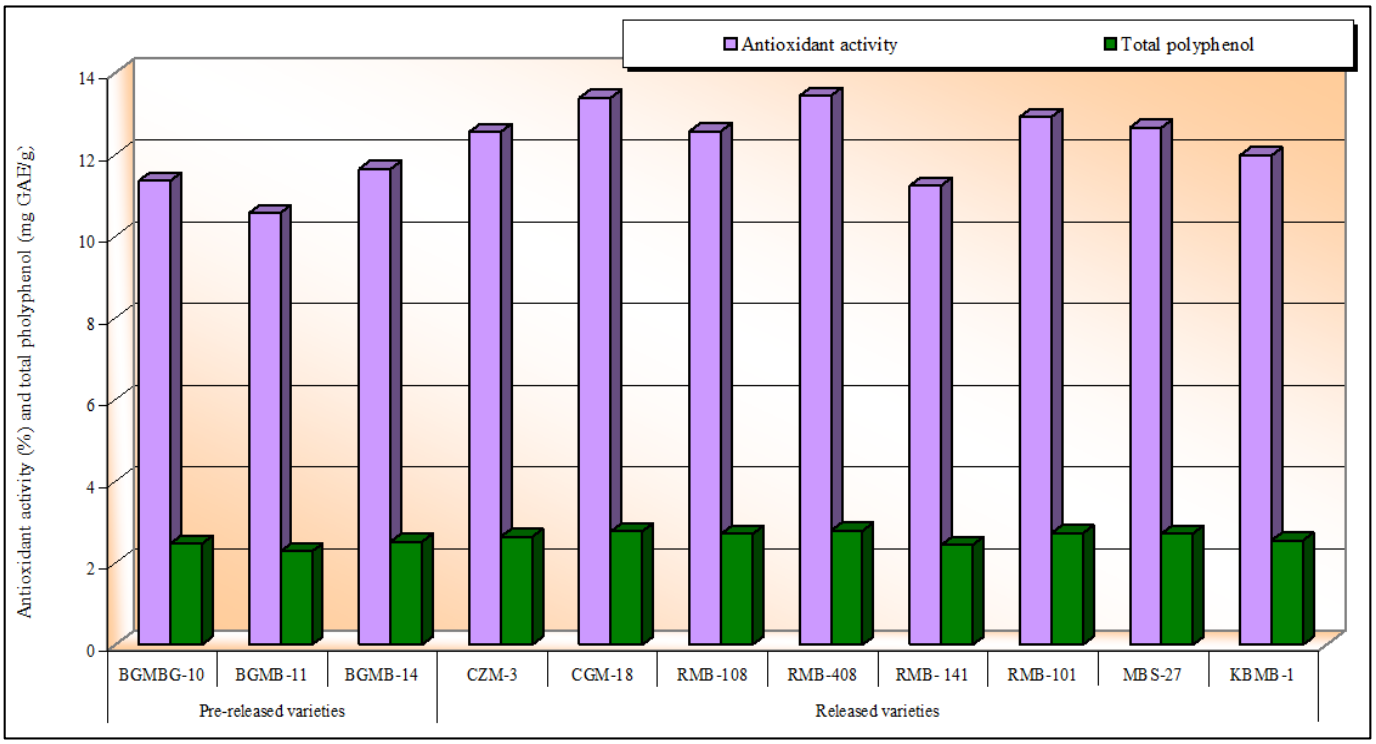

Fig 1: Antioxidant activity and total phenolic content of mothbean varieties

Conclusion: Among the studied eleven varieties, RMB-141 was having highest protein content (26.08 g/100 g) and KBMB-1 was having highest crude fiber content (5.16 g/100 g). In the antioxidant and polyphenol content, RMB-408 was found to be highest (13.44 percent and 2.79 mgGAE /g respectively).

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