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COMPARISON OF PHYSICOCHEMICAL PROPERTIES OF SELECTED LOCALLY AVAILABLE LEGUMES VARIETIES (MUNG BEAN, COWPEA AND SOYBEAN)

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ABSTRACT
Grain legumes are widely used as high-protein contained crops that play a secondary role to cereal or root crops. In Sri Lanka various legume species are cultivated and often utilised in the whole grain boiled form. The objective of present study was to analyse and compare locally grown legumes varieties; Mung bean (MI 5, MI 6), Cowpea (Bombay, Waruni, Dhawal, MICP1, ANKCP1) and soybean (pb1, MISB1) for their morphological characteristics, proximate and mineral composition (Fe, Ca, Zn, K, P). Seed shape, seed coat texture and colour, seed size and 100 seed weight (g) were observed morphological characteristics in present study. Most of the characteristics of mung bean and soybean were similar within their species whereas characteristics of cowpea varieties largely differed. Values of 100 seed weight among the varieties of mung bean, soybean and cowpea were ranged from 5.8 – 6.5 g, 13.5 – 14.1 g and 13.4 – 17.2 g, respectively. The moisture content of all legume seeds ranged from 6.81% to 11.99%. Results were shown that the protein content significantly higher in soybean (36.56 – 39.70%) followed by mung bean (26.56 – 25.99%) and cowpea (25.22 – 22.84%) respectively. Range of total carbohydrate, crude fat, crude fibre and total ash contents of nine legume varieties varied from 15.29 – 62.97%, 1.25 – 22.02%, 3.04 – 7.93% and 3.43 – 6.35 respectively. potassium (K), phosphorus (P), calcium (Ca), iron (Fe) and zinc (Zn) ranged from 1000 – 1900, 360 – 669, 15.0 – 192.3, 2.26 – 11.6 and 1.67 – 4.26 mg.100g^{-1} respectively in all the species of studied legume varieties. The wide variation in the chemical and physical properties of observed nine legume varieties, suggesting possible applications for various end-use products.

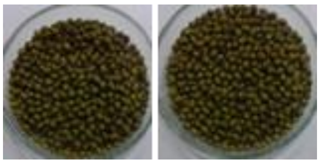
Keywords: legume; morphological characteristics; proximate; minerals composition

INTRODUCTION
In Sri Lanka, various legume species are cultivated. Being a cheap source of protein for the low-income group of the population, legumes are commonly used as a substitute for meat and they play a significant role in alleviating the protein-energy malnutrition. Most undernourished people live on a mono carbohydrate diet (i.g. maize or rice) which are in lacking of the required protein, fat, vitamin A, iodine, zinc and iron. Therefore incorporation of legume and pulses with other locally grown grains has a potential to reduce some extend of the protein malnutrition problems. Usually legumes are consume as whole or split form and it is cooked by follwing precooking process such as soaking **(Timoracká et al., 2010)**. Legume contain about 17 – 40% of protein which is comparable to cereals, 7 – 13% and to meat, 18 – 25% **(Genovese and Lajolo, 2001)**. The vitamin and mineral content of pulses also significance. They are rich in both major mineral elements (Mg, Ca, K, P) as well as trace elements (Fe, Cu, Zn, Mn) but very little amount of sodium **(Timoracká et al., 2011; Uebersax and Occena, 1991)**. Mung bean (*Vigna radiate wilczek*), Cowpea (*Vigna unguiculate*), soybean (*Glycine max L.*), black gram (*Vigna mungo L.*), groundnut (*Arachis hypogaea L.*) and Dhal (*Lens culinaris*) are mostly consumed legumes among Sri Lankan people and find different applications.

In the present study, some locally grown selected legumes have been recognised as economically important (Mung bean-*Vigna radiate L*, Cowpea-*Vigna unguiculata L* and Soybean-*Glycine max L*) were evaluated for their morphological characteristics, proximate and mineral composition with an intention to screen better variation for processing in future use.

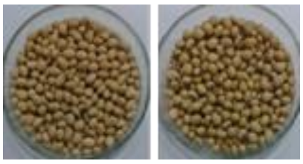
MATERIAL AND METHODOLOGY
Two varieties of mung bean (MI5 and MI6), two varieties of soybean (pb1and MISB1) and five varieties of cowpea (ANKCP1, MICP1, Bombay, Wauni and Dhawala) recommended by the Department of Agriculture, Sri Lanka were selected for this study (Figure 1, 2 and 3) and they were obtained from Grain Legumes and Oil Seed Crops Research and Development Centre (GLOSCRDC), Angunakolapelessa, the main agriculture research centre located in Southern Dry Zone in Sri Lanka.

Sampling method
For the selection of legume seeds, random sampling method was performed and all varieties were collected from the same field with same environmental conditions and agricultural practices.



MI 5 (b) MI 6

Figure 1 Mungbean varieties.



(a) pb1 (b) MISB

Figure 2 Soybean varieties.

(a) Bombay (b) Waruni (c) Dhawala

(d) MICP 1 (e) ANKCP

Figure 3 Cowpea varieties.

Assessment of morphological characteristics

To identify and define the specific morphological characteristics, Seed shape, seed coat texture (wrinkled/ smooth), seed coat colour were described after visual examination. Seed size and seed weight (on their 100 seed weight) were determined following the procedure described by **Henshaw (2008)**. Weight less than 15.0 g were described as small; 15.1 – 20 g were as medium size while large seeds have 20.1 – 25 g and seeds over 25 g of weight defined as very large seeds.

Sample preparation for proximate and mineral analysis

Clean and dry whole legume seeds were ground to pass a 0.5 mm sieve using a laboratory type mill (Model-RETSCH S/S CROSS BEATER Hammer Mill Sk1). Then the powdered samples were homogenised and stored in polyethene bags at 10 ºC until use for analysis.

Proximate analysis

Proximate composition of legume seeds were carried out according to the methods described in **AOAC (2012)**. Every determination of composition values were performed in triplicates. Moisture contents of the legume seed flours were determined according to the oven drying method as described in **AOAC (2012)** 925.09B, applying gravimetric principal. Crude protein content of the legume seed flour was determined by micro-kjeldahl method as specified in **AOAC (2012)** 920.87 using Kjeldahl heating digestion unit (VELP Scientifica DK 20) and Kjeldahl semi distillation unit (VELP Scientifica DK 139). Crude fat content was determined by soxhlet extraction method according to **AOAC (2012)** 920.39C using Automatic extraction systems Soxtherm (C. GERHARDT GMBH & CO. KG Analytical Systems). Crude fibre content was determined according to the method described in **AOAC (2012)** 962.09E using Fibertec™ M6 Fibre Analysis System (FOSS-1020 HOT EXTRACTOR). Ash content was determined as specified in AOAC (2012) 923.03 by dry ashing method with gravimetric principal. Total carbohydrate content was determined according to the method described by **Sompong (2011)**.

Mineral analysis

Varian SpectrAA 220 Fast Sequential Atomic Absorption Spectrophotometer was used for the analysis of calcium, potassium, iron and zinc by following the method of 975.03 as specified in **AOAC (2012)**. Phosphorous contents of seeds were determined colorimetrically sodium molybdate according to the method 995.11 as specified in **AOAC (2000)**.

Statistical analysis

The data were statistically evaluated by one-way analysis of variance (ANOVA) by using Minitab 17 software (Minitab, Ltd. Brandon Court Unit E1-E2, Progress Way, Coventry CV3 2TE, UNITED KINGDOM). General linear model was used for comparison between legume varieties. All test procedures were made at 5% significant level. Also Microsoft Office Excel 2010 was used to graphical representation of data.

RESULTS AND DISCUSSION

Determination of morphological characteristics of selected legume variety

Studying of morphological characteristics helps to the selection of suitable variety for the purpose of cultivation as well as distinguishes between particular species and varieties within a species. Morphological characteristics of studied legume varieties are mentioned in Table 1. Most of the characteristics of mung bean and soybean are similar within their species whereas characteristics are largely different within cowpea. Mung beans are usually oblong in shaped and cowpea seeds varied from the typical kidney shape (Bombay, MICP 1) to rhomboid (Waruni, Dhawala, ANKCP 1) shape. The common shape of soybean varieties observed in this study was spherical. Shape of legume seed is mainly applicable for consumer preference for consuming and processing like snacks, canning, autoclaving, etc. Cooking and moisture absorption properties are accordance with the nature of seed coat texture, either smooth or wrinkled **(Sefa-Dedeh et al., 1978)**. Seeds with wrinkled seed coat texture have ability to absorb more water than seeds having smooth seed coat. Method of dehulling and soaking determine the color of final seed flour. Hence seed coat texture can be considered as an important criterion when processing seeds into flour **Henshaw (2008)**. Only two cowpea varieties (Bombay and Dhawala) were showed wrinkled texture among observed seeds. When considering seed coat colors, typically mung bean is in green color and soybean is in cream color. Color of cowpea varieties were largely varied and highly influenced consumer acceptance.

Here, it was observed that colors of cowpea varieties have been given particular diversity which is directly helped to distinguish each variety within the species. The cream colored seed (Dhawala and ANKCP 1) are preferred

Table 1 Morphological characteristics of selected mung bean, cowpea and soybean varieties.

Name of Variety	Seed shape	Seed coat texture	Seed coat colour	Seed Size	Seed weight of 100 seeds(g)
Mung Bean					
1. MI 5	Oblong	Smooth	Green	Small	5.8
2. MI 6	Oblong	Smooth	Green	Small	6.5
Cowpea					
3.Bombay	Kidney	Wrinkled	Speckled grey brown	Medium	15.3
4. Waruni	Rhomboid	Smooth	Reddish brown	Small	14.5
5.Dhawala	Rhomboid	Wrinkled	Cream colour with black eyed	Medium	17.2
6. MICP1	Kidney	Smooth	Cream color	Small	13.8
7.ANKCP 1	Rhomboid	Smooth	Pale brown colour	Small	13.4
Soybean					
8. pb 1	Spherical	Smooth	Cream color with a buff colour hilum	Small	13.5
9. MISB 1	Spherical	Smooth	Cream colour with a buff colour hilum	Small	14.1

than brown, red colored (Bombay and Waruni) seeds because they provide a sensory appeal by their color. Seed weight is mostly contributed from the kernel (Cotyledons and embryo) which make up about 88.8% and seed coat takes about 11.1% of the seed weight **(Singh et al., 1995; Kurien, 1977)**. Mung bean is the smallest seed among cowpea and soybean varieties and had less in weight, but both MI 5-1982 and MI 6-2004 are comparatively larger than other mung varieties recommended in Sri Lanka such as Harsha-1990 (4.8g in 100 seed wt) and Ari-1999 (5.8 g in 100 seed wt) **(Wasala et al., 2011)**. Smaller seeds of the mung bean variety Harsha fetched a lower price whereas MI5 always fetched a higher price even though Harsha possessed same physical characteristics with less mature time of seeds **(Hettiarachchi et al., 1998)**. Therefore seed weight of legume variety could be a useful criterion for determining suitability for a particular end-use application. Most of local cowpea varieties were small in size and Dhawala and Bombay were medium in size. There are 28 cowpea varieties have been studied by **Henshaw (2008)** and 100 seed weight varied between 10.1 g to 25.8 g. **Amiruzzaman (2003)** indicated that the average seed weight of soybean seeds are ranged between 15 – 40 g in 100 seeds. In this study, pb 1 and MISB 1 varieties were classified with small in size and the corresponding weights were 13.5 g and 14.1 g (in 100 seed weight) respectively.

Quantitative determination of proximate composition of legume seeds (Mung bean, Cowpea and Soybean)

In generally, cotyledons provide majority of the nutritional components, which makes 93% seed proteins, 95% fat, 87% ash and 88% nitrogen free extract-NFE in whole seed **(Singh et al., 1968)**. In present study moisture content of observed legume species were expressed in Table 2 and results ranged from 6.81 ±0.05% to 11.99 ±0.48%. The highest value was obtained from mung bean, MI 5 (11.99 ±0.48%) and the lowest from cowpea, MICP 1 (6.81 ±0.05%). In the case of mung bean, similar findings were observed by other scientists but with slight variations. **Akaerue and Onwuka (2010)** reported that the moisture content of the raw undehulled mung bean flour (*Vigna radiate*) was 10.25%. A study from, **Butt and Batool (2010)** showed comparatively lower value for moisture content of mung bean (8.81% – 7.79%). However, other researchers had earlier reported that *Phaseolus aureus* variety had 9.75% of moisture content which were in agreement of our results **(Mubarak, 2005)**. Moisture content of Bombay, Waruni and ANKCP 1 were significantly ($p \leq 0.05$) higher than those for Dhawala and MICP 1. Similar observations on the moisture content of different cowpea varieties have been reported by several investigations. **Butt and Batool (2010)** had reported that moisture content of *Vigna unguiculata L* is 9.66% – 11.12% and 13.22% is the results of **Mwasaru et al., (1999)**.

When consider the mean values of soybean, no significant difference ($p > 0.05$) was found between pb 1 and MISB 1 in their moisture content. It is in agreement with those reported by **Joshi et al., (2015),** the moisture content for full fat seed flour ranged between from 8.54% to 10.20%. However, slight variations may be due to genotype and environmental conditions **(Qayyum et al., 2012)**.

According to the results mentioned in Table 3 the crude protein content of the whole ground legume (undehulled) ranged between 22.84 ±0.09% (Dhawala) to 39.70 ±0.43% (MISB 1). The findings of **Adam et al., (1989)** were in conformity with these values and which amplified that crude protein content of the selected legumes ranged from 15% to 45%. In this context, no significant difference ($p > 0.05$) was observed between the protein content within mung bean varieties. Current results are resemblance with other research, which was reported that protein content of *P. aureus* and *Vigna radiate* remained as 27.5% **(Mubarak, 2005)** and 24.08% **(Blessing and Gregory, 2010)** respectively. In cowpea varieties, the protein content of Dhawala was significantly ($p \leq 0.05$) lower than observed other four cowpea varieties. In this regards,

Table 2 Moisture content of selected legume varieties of mung bean, cowpea and soybean.

Name of Variety	Moisture content ($g.100g^{-1}$ of sample ±SD)
Mung bean	
1. MI 5	11.99 ±0.48 ^{a}
2. MI 6	11.48 ±0.22 ^{ab}
Cowpea	
3. Bombay	11.05 ±0.39 ^{ab}
4. Waruni	11.05 ±0.06 ^{ab}
5. Dhawala	9.50 ± 0.05 ^{c}
6. MICP1	6.81 ±0.05 ^{d}
7. ANKCP 1	10.99 ±0.10 ^{b}
Soybean	
8. pb 1	9.24 ±0.62 ^{c}
9. MISB 1	9.57 ±0.37 ^{c}

Note: Results were expressed in Mean ±Standard deviation of triplicates and means with same superscript in column are not significantly different (p >0.05).

Elharadallou (2013) explicated that protein content of *Vigna unguiculata L.* was 22.30% while value obtained by **Elias et al., (1964)** for *Vigna sinensis* was 27.5%. The array of investigations, variations in protein content have been observed owing to analytical methods, genotype, different environments and agricultural practices. Generally speaking, soybean are rich in protein is collaborate with present findings. According to that protein content of soybean varieties were notably higher than both mung bean and cowpea. But protein content of MISB1 was significantly (p ≤0.05) higher than pb 1. Protein concentration is highest in the embryo, followed by cotyledons and least in the seed coats. Because of the size, cotyledons contribute for the maximum protein amount. Protein concentration of grains also varies with the cultivar and the same cultivar grown at different areas **(Gottschalk and Mũller, 1983)**.

The fat content of soybean is prominent than both mung bean and cowpea varieties. By the reason, soybean generally speaks as oil seed. The low-fat content in mung bean and cowpea is an advantage during processing it into flour, since there is no need for a defatting step in seed flour production **(Henshaw, 2008)**. In values reported in this study, fat content of all three legume species ranged from 1.25 ±0.03% (MICP 1) to 22.02 ±0.05% (pb1). Fat content of mung bean varieties were not significantly differ (p >0.05) from each other while similar findings have been reported previously by **Mubarak (2005)** and **Blessing and Gregory (2010)**. Most of cowpea varieties exhibited slightly high-fat content rather than mung bean varieties and the values show no significant difference (p >0.05) between each other. Studies conducted by **Elharadallou (2013)** and **Elias et al., (1964)** found same value (2.1%) for fat content of *Vigna unguiculata L* and *Vigna sinensis* which is collaborated with present findings. In the case of soybean, fat content of pb 1 was significantly (p ≤0.05) higher than the value of MISB 1. Results are also in agreement with the findings of **Namiki (1995)** 21.88% for *Glycine max*.

Legumes contained more fibre than any major food group. Some fibre are soluble and others insoluble. In most legumes consumed by humans, the fibre content ranges from 8% to nearly 28% **(McGreevy, 2008)**. As the values presented in Table 3 there is no significant difference (p >0.05) between crude fibre content of two mung bean varieties and these findings are supported by **Mubarak, (2005)** 4.63% for *P. aureus* and **Blessing and Gregory,**

Table 3 Proximate composition of different legume varieties of mung bean, cowpea and soybean (on dry weight basis).

	Composition ($g.100g^{-1}$ of sample ±SD)				
	Protein	**Fat**	**Fibre**	**Ash**	**Carbohydrate***
Mung Bean					
MI 5	25.99 ±0.24 ^{cd}	1.54 ±0.01^{cd}	5.55 ±0.05^{cd}	3.96 ±0.04^{e}	62.97
MI 6	26.56 ±0.10 ^{c}	1.25 ±0.03^{d}	5.01 ±0.13^{d}	3.95 ±0.04^{e}	51.75
Cowpea					
Bombay	24.98 ±0.24^{e}	1.81 ±0.06^{cd}	4.36 ±0.16^{e}	3.43 ±0.01^{h}	52.22
Waruni	25.03 ±0.25^{e}	1.51 ±0.04^{cd}	6.84 ±0.15^{b}	3.78 ±0.01^{f}	58.76
Dhawala	22.84 ±0.09^{f}	1.72 ±0.08^{cd}	5.06 ±0.21^{d}	3.62 ±0.03^{g}	54.37
MICP1	25.22 ±0.27 ^{de}	1.86 ±0.04^{cd}	3.04 ±0.10^{f}	4.3 ±0.03^{c}	51.79
ANKCP1	24.90 ±0.23^{e}	2.03 ±0.57^{c}	5.75 ±0.37^{c}	4.10 ±0.05^{d}	57.24
Soybean					
pb 1	36.56 ±0.22^{b}	22.02 ±0.05 ^{a}	7.93 ±0.13 ^{a}	6.14 ±0.00 ^{b}	18.11
MISB 1	39.70 ±0.43^{f}	21.17 ±0.18 ^{b}	7.93 ±0.25 ^{a}	6.35 ±0.01 ^{a}	15.29

Note: Results were expressed in Mean ±Standard deviation of triplicates and means with same superscript in column are not significantly different (p >0.05).
* Standard deviations are not applicable for figures of carbohydrate since they are obtained by subtracting sum of average values of other nutrients from 100%.

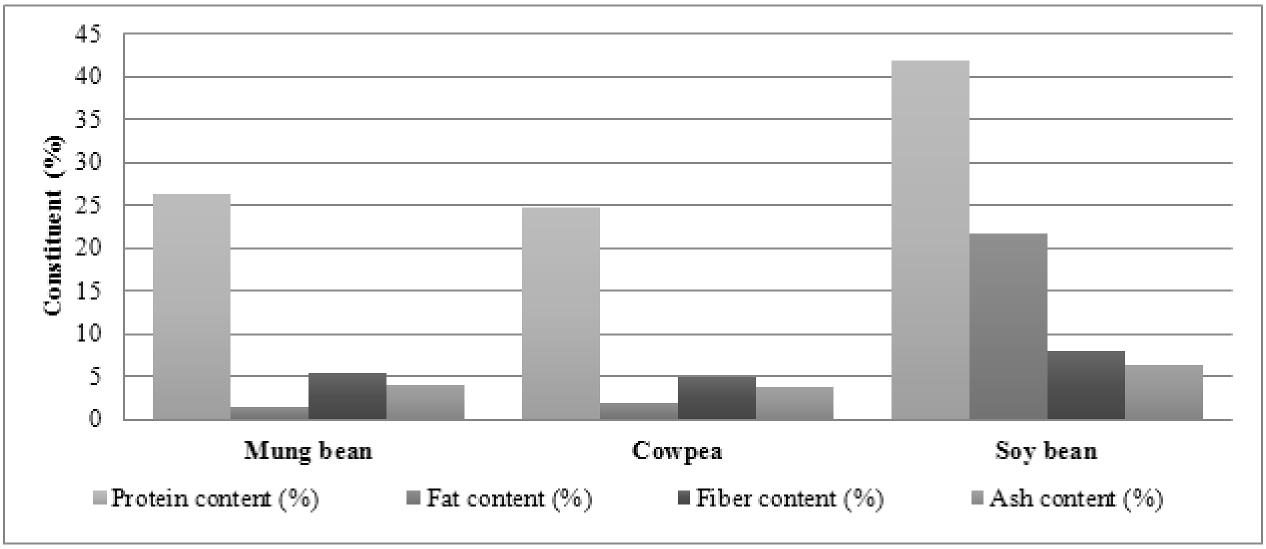


Figure 4 Average proximate composition (on dry basis) of mung bean, cowpea and soy bean. Mean (n = 3).

(2010) 5.00% for *Vigna radiate* in fibre content. Soybean also did not exhibits significant difference (p >0.05) between fibre content while these represent higher values among selected nine varieties in this study. However, present results slightly vary from previous literature, as the value reported by **Namiki (1995)**, fibre content of *Glycine max* was 9.0%**.** Although mung bean and soybean show no significant difference within their species, significant variations (p ≤0.05) were existed in fibre content in cowpea varieties. However, lowest value was observed in MICP 1 and the highest value was in Waruni.

Present results are comparable to the earlier findings **(Elharadallou, 2013; Elias et al., 1964)**. They reported that 4.10% and 7.0% of fibre contents for *Vigna unguiculata L.* and *Vigna sinensis* respectively. The causes for observed variations in cowpea varieties are depend on the type of legume species, the variety within same species, and the processing of the legume (Milling conditions, particle size, etc.) **(McGreevy, 2008)**.

The mean values for total ash content of selected nine legume varieties ranged from highest 3.43 ±0.01% (Bombay) to lowest 6.35 ±0.01% (MISB 1). There is not significant difference reported (p >0.05) in the ash contents of mung bean varieties. Previous studies have been found that 3.76% ash content for *P. aureus* and 3.00% for *Vigna radiate* **(Mubarak, 2005; Blessing and Gregory, 2010)**, which are in agreement with the ash content of MI 5 and MI 6. Total ash content of cowpea varieties show significant difference (p ≤0.05) from each other. It was reported that ash content of *Vigna unguiculata L.* was 3.77% and the value for *Vigna sinensis* was 4.9% **(Elharadallou, 2013; Elias et al., 1964)**, showing that present results are in accordance with previous research. When considering the results of ash content in soybean varieties, the value for pb 1 was significantly *(p* ≤0.05*)* lower than the value for MISB1. Also, ash contents in present study are very much deviate from the studies of **Cheftel et al., (1985)** (i.e. 4.9%) and **Namiki (1995)** (i.e. 2.59%). The significance variations of the result would be better interpretation to that variety cultivated under different cultural conditions such as soil composition, climatic and agronomic practices **(Henshaw, 2008)**.

Carbohydrate content of legume seed ranged from 15.29% (MISB 1) to 62.97% (MI5). For most of legumes, the largest part of the carbohydrate fraction is starch, accounting for about 35% – 45% of the seed weight depending on the legume species **(Hedley, 2001)**. Carbohydrate values of MI 5 and MI 6 in present study are in agreement with the results of **Mubarak (2005**) and **Blessing and Gregory (2010)**. As they reported, values of carbohydrate contents are 62.3% for *p. Aureus* and 55.74% for *vigna radiate* respectively.

Among cowpea varieties, carbohydrate content ranged from 51.79% to 58.76%. Similar values were followed by **Elharadallou (2013)** for *Vigna unguiculata L.* (60.07%) and **Elias et al., (1964)** for *Vigna sinensis* (58.5%). In case of soybean the highest carbohydrate content was reported from pb 1 (18.11%) while lowest was MISB 1 (15.29%). But both values are severely deviated from the value (44.06%) reported by **Namiki (1995)**. Total carbohydrate content analysis which is not determined analytically but is calculated by difference. Since the result is obtained by subtracting the total percentages calculated for each macro nutrient from 100, any errors in evaluation will be reflected in the final calculation. Hence lower value for carbohydrate in soybean seed could be observed in present study due to higher number of other compositional components (i.e. mainly protein) than the findings of others.

Quantitative determination of mineral composition of legume seeds (mung bean, cowpea and soybean)

Results for the mineral analysis are presented in Table 4. Iqbal et al., (2006) indicated that potassium is the most abundant mineral among legume seeds. It has been observed from the current study and values ranged from 1000 to 1900 mg.100g^{-1} of sample. Phosphorous, copper, iron, calcium and magnesium are some of other important minerals found in legumes in significant amount **(Eskin and Shahidi, 2012)**. Whereas concentrations will vary in response to both genetic and environmental factors. Both

Table 4 Mineral composition of different legume varieties of mung bean, cowpea and soybean (on dry weight basis).

Name of Variety	Composition (mg.100g^{-1} of sample ±SD)				
	Iron (Fe)	Calcium(Ca)	Zinc(Zn)	Potassium(K)	Phosphorus (P)
Mung Bean					
MI 5	2.69 ±1.07 ^{c}	29.0 ±4.33 ^{c}	1.67 ±0.12 ^{c}	1000 ±5.51 ^{f}	394 ±1.53 ^{e}
MI 6	2.83 ±0.18 ^{c}	27.4 ±3.13 ^{c}	1.71 ±0.2 ^{c}	1200 ±6.24 ^{d}	438 ±4.04 ^{c}
Cowpea					
Bombay	3.54 ±0.32 ^{c}	27.8 ±3.03 ^{c}	2.82 ±0.39 ^{bc}	1300 ±14.18 ^{c}	360 ±2.08 ^{g}
Waruni	3.49 ±0. 06 ^{c}	29.9 ±5.11 ^{c}	2.63 ±0.19 ^{c}	1200 ±9.07 ^{d}	424 ±2.65 ^{d}
Dhawala	2.42 ±0.45 ^{c}	23.3 ±2.39 ^{cd}	2.20 ±0.17 ^{c}	1100 ±11.93 ^{e}	372 ±1.53 ^{f}
MICP1	2.26 ±0.03 ^{c}	29.4 ±3.58 ^{c}	2.04 ±0.72 ^{c}	1000 ±6.03 ^{f}	441 ±5.03 ^{c}
ANKCP1	2.83 ±0.33 ^{c}	15.0 ±2.81 ^{d}	2.30 ±0.47 ^{c}	1200 ±7.64 ^{d}	396 ±4.04 ^{e}
Soybean					
pb 1	11.6 ±0.42 ^{a}	153.3 ±1.47 ^{b}	4.26 ±0.91 ^{a}	1700 ±8.00 ^{b}	587 ±2.52 ^{b}
MISB 1	7.91 ±0.41 ^{b}	192.3 ±2.18 ^{a}	4.07 ±0.28 ^{ab}	1900 ±9.07 ^{a}	669 ±2.08 ^{a}

Note: Results were expressed in Mean ±Standard deviation of triplicates. Means with same superscript in column are not significantly different (p >0.05).

soybean varieties (pb 1 and MISB 1) contained remarkable quantities of iron, calcium, zinc, potassium and phosphorus when to compare mung bean and cowpea varieties and might thus be of nutritional interest. Iron and zinc contents are remarkably higher in legumes than the cereals. Therefore it is very beneficial to go for composite feeding and supplementary food formulations for under nourished groups using legumes because in biological system, trace minerals (Mn, Zn and Fe) play a vital role **(Timoracká et al., 2011)**.

CONCLUSION

Based on visual and instrumental evaluations seed assessments discovered that more variations could be seen between varieties within cowpea, but mung bean and soybean showed minor variation by only in the seed weight. As general speaking, soybean recorded markedly higher protein content and fat content while observed values show next higher protein content and fat content in mung bean varieties. Legumes have more fibre than any major food group, among them soy bean reported highest. Ash contents of soybean were significantly higher than mung bean and cowpea varieties and it is explicated by relatively higher amount of potassium, phosphorus, calcium, iron and zinc in mineral analysis. In nutritional point of view, tested legumes; mung bean, cowpea and soybean are good sources of protein, zinc and iron compare to cereal and it is better for composite mix formulations for malnourished population.

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