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Profiling of Nutritional and Anti-nutritional Factors in Selected Minor Millets

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ABSTRACT: The research was conducted at Agricultural College & Research Institute, Vazhavachanur of Tamil Nadu, India during the period from June 2019 to May 2022. In the study, five different millets and two varieties of each cultivated in and around Tiruvannamalai district of Tamil Nadu as the test cereal grains in completely randomized design with three replications were tried. Biochemical estimations were carried out to study the nutritional and mineral status in foxtail millet (ATL1, CO (Te) 7), kodo millet (CO 3, TNAU 86), little millet (CO 4, ATL1), barnyard millet (MDU 1, CO (KV) 2) and proso millet (ATL 1, CO (PV) 5). Simultaneously anti-nutritional factors were also quantified for the same grain samples. Results showed that Proso millet, variety ATL 1 has recorded the highest percentage of crude protein i.e. 12.2% and total protein 11.0% at moisture content 11.42% among the millets tested. Little millet, variety ATL 1 has recorded the highest carbohydrate content (71.2%) and starch content (69.2%) at moisture content 9.02% among the millets tested. Barn yard millet, CO 2 has recorded the highest percentage of amylose i.e. 29.3 g/100g starch and highest percentage of Resistant Starch i.e. 5.3 g/100g starch. Barn yard millet, variety MDU 1 has recorded the highest content of total phenols i.e. 14.40 mg/100g at moisture content 8.73%. Barn yard millet, MDU1 has recorded the highest Total flavonoids content i.e. 6.78 mg/100g. Proso millet, variety ATL 1 has recorded the negligible quantity of Tannin content i.e. 0.06mg/100g. Little millet, variety ATL 1 has recorded the lowest quantity of Phytic acid content i.e. 23mg/100g. Results revealed about a considerable variation in levels of different Biochemical traits due to the nature of minor millets and also based on the genotypes. The biochemical information's on non-protein nitrogenous compound percentage, resistant starch percentage and carotenoid content, ratio of total phenol and total flavonoid, tannin content were not mentioned clearly in the previous literature. This study gives the information clearly. The overall results of this study revealed that Proso millet, variety ATL 1 and Barn yard millet, varieties CO 2 and MDU1 were considered as top three minor millets among the tested sources.

Keywords: Biochemistry, Barn yard millet, Millets, Nutrition, Proso millet, Resistant Starch, Tannin and Total phenols.

INTRODUCTION

Small millets are small seeded grains largely grown in the semi-arid tropical regions of Asia and Africa, under rainfed farming systems. They are grouped into sixtypes, namely finger millet (*Eleusine coracana* (L.)), little millet (*Panicum sumatrense*), kodo millet (*Paspalum scrobiculatum* (L.)), foxtail millet (*Setaria italica* (L.)), barnyard millet (*Echinochloa frumentacea* (L.)) and proso millet (*Panicum miliaceum* (L.)).

Small millets grains are rich in dietary fibre, vitamins and several minerals (iron, calcium and zinc). It is also rich in insoluble dietary fibers and phyto chemicals with antioxidant properties. Hence, minor millets are referred as "Nutri-cereals". Since, it is rich in bio active compounds, it could be used for several chronic diseases like ischemic strokes, cardiovascular disease, cancer, obesity and Type II diabetes mellitus.

These crops were grownup globally in a limited domain, and are used for food, feed and fodder purposes. Small millets have many advantages in cultivation and practices, including diverse adaptation, short-duration, less affected by biotic and abiotic stresses like drought tolerance, high water use efficiency. Small millets are the source of important food grain in their areas of cultivation, while their straw is highly valued as fodder. Small millets are under-utilized and continued to neglect in terms of production, promotion, consumption, research and development. Nowadays, the small millet grains, receiving higher attention because of their bioactive compounds, high dietary fiber and low glycemic index. India is considered as hub for minor millets and Karnataka is the predominant state.

Plants commonly synthesize a set of secondary metabolites to protect themselves against herbivores, insects, pathogens and abiotic stresses like salinity, sodicity, drought and frost. Millets inherently carry certain anti-nutritional factors to keep the predating insects at bay, each of which might directly or indirectly affect the digestibility of nutrients.

Rice and wheat provide the security of food while millets give security of nutrition and health. Kodo millet helps in reducing joints, knee pain and gastro intestinal ulcers. Proso millet (*Panicum miliaceum* L.), commonly known as yellow rice, is one of the oldest crops in the world (Han *et al*., 2021). Proso millet oriented diet may decrease the insulin dosage in diabetes mellitus patients (Yu Wen *et al.,* 2014).

Resistant starch (RS) is a part of starch molecule found in all starch with variation in percentage also known as indigestible starch. Resistant starch can be used as a thickening agent in dairy products and soup (Regassa and Nyachoti 2018; Han *et al*., 2021). Intake of Resistant starch decreases postprandial glycemic index and improves physical fitness (Ma *et al*., 2018; Han *et al*., 2021). Biochemical composition of particular diet may tend off the human pathological problems like cancer and neuropathy.

Hence, the present study aims at assessing the nutritional and antinutritional factors present in the minor millets *viz.,* foxtail millet, kodo millet and little millet varieties of Centre of Excellence in Millets, Athiyandal and main campus of TNAU which could be useful for mankind and food industries.

MATERIALS AND METHODS

Materials. This research was conducted at the Agricultural College & Research Institute, Vazhavachanur-606 753, Tiruvannamalai District, India during the period from June 2019 to May 2022. The Experimental site is geographically located at Altitude 58MSL, Latitude 12°04' N and Longitude 78°59' E in the Thandarampattu block of Tiruvannamalai district.

The materials used in this research were five different millets and two varieties of each being cultivated in Athiyandal region of Tiruvannamalai district of Tamil Nadu as per the recommendations for cultivation practices.1kg sample of each millet variety were procured from three different sampling locations. Damaged grains were not considered for observation.

Methods

Estimation of Protein (Lowry et al., 1951). Protein content of extracted concentrate from millet grain was determined spectrophotometrically by Lowry *et al.* (1951). The amount of protein in sample was calculated from standard curve prepared simultaneously with bovine serum albumin (40-200µg/ml) as standard.

Determination of Crude Protein content (Micro-Kjeldahl method). The crude protein content of the fresh weight samples of millet grain was determined as percent total nitrogen by the Micro-Kjeldahl digestion and distillation procedure. Protein percent was calculated by multiplying the percent nitrogen by the factor 6.25 (AOAC, 1980).

Determination of Total Carotenoids. Total carotenoids are extracted and partitioned in organic solvent, acetone on the basis of their solubility, followed by mixing with petroleum ether, petroleum ether layer was separated by using separating funnel and kept in boiling water bath. After the residue formation, dissolved by 22ml ethanol and 3ml 60% KOH solution. Total volume of carotenoid solution became 25ml and the absorbance was measured at 450nm (Sanganna, 1986).

Determination of Moisture Content. The percentage of moisture was measured by the methods of Association of Official Analytical Chemists Society (AOAC, 2000).

Other Biochemical Estimations. Estimation of Total Carbohydrate by Phenol-sulphuric acid method (Dubois *et al*., 1956), Estimation of Total Starch by Acid hydrolysis and Anthrone method (Ranganna, 1986). Amylose content was estimated by using Iodine by the method of Juliano (1971). The Resistant starch content of millet grain samples was assessed using the method described by McCleary and Monaghan (2002). Soxhlet extraction method was used to determine the fat content (AOAC, 2003), Total Phenol content of the millet grain samples were estimated with gallic acid as a standard (10 to 50 µg) by Folin-Ciocalteau method (Bray and Thorpe, 1954). Total Flavonoid content of the millet grain samples were estimated with quercetin as a standard (10 to 50 µg) by Aluminium chloride colorimetric assay method (Zhishen *et al.,* 1999).

Tannin content of millet grain samples was estimated with tannic acid as a standard in alkaline condition by Folin Denis method as described by Sadasivam S. and Manickam A. Phytic acid content in defatted millet grain flour samples was determined with phytate phosphorus salt as a standard by the method of Davies and Reid (1979).

Determination of Calcium and Magnesium contents by versanate method (Diehl *et al.,* 1950), Phosphorus content was determined by Vanado-molybdate method (Koenig and Johnson 1942) by using spectrophotometer at 470 nm wavelength. Sodium was determined by the method described by Piper (1966), Determination of Iron by the method of Lindsay and Norvell (1978), Determination of Copper by Callen and Henderson (1929). Determination of Zinc by Cowling and Miller (1941). Chromium content of selected minor millet grains was determined with Trivalent chromium as standard by graphite furnace atomic absorption spectroscopy (GFAAS) (Bratakos *et al.,* 2002).

Statistical Analysis. The experiments, quantification of biochemical parameters were performed in triplicate, using three independent replicates of each millet and their genotype in a completely randomized design. All results were expressed as the mean value. The data obtained were subjected to statistical scrutiny (Steel and Torrie 1960). Wherever, the treatment differences were significant, critical differences were worked out manually at five percent probability level.

RESULTS AND DISCUSSION

The selected small millet flour samples contain moisture in the range of 8.33 % to 11.42% (Table 1).

Nutritional composition of Foxtail millet in per 100gm in the variety [ATL1], has recorded 9.6% Protein, [11.13% Crude protein] with moisture content, 10.96% and also recorded 2.31%, Total fat 59.4%, total carbohydrate 4.1%, Resistant starch 17.9%, Amylose, 180µg, total carotenoids, 3.6 mg, total phenols, 2.67 mg Total flavonoids, 0.67 mg Tannin content and 45mg Phytic acid content (Table 1 and 2).

Nutritional composition of Kodo millet in per 100gm. 10% Protein both in CO 3 and TNAU 86 variety at 8.55 and 8.6% moisture content respectively. The percentage of non-protein nitrogenous compounds in kodo millet is approximately found to be 1.2%, Total fat recorded as 3.77% and 4.35% in CO 3 and TNAU 86 variety respectively. TNAU 86 variety has recorded 66.2% Total carbohydrate, 24.3% Amylose and 4.7% Resistant starch, 273µg Total carotenoids, 10.4 mg Total phenols, 4.6 mg Total flavonoids and 0.53mg Tannin content. Kodo millet variety, CO 3 has recorded 34mg Phytic acid content (Table 1 and 2).

Table 1: Nutritional Profile of selected minor millets at fresh weight basis [Unpolished].

Name of the millet	Variety	Total carbo-hydrate [g/100g]	Total Starch [g/100g]	Amylose % of starch	Amylo pectin % of starch	Resistant Starch [g/100g starch]	% of Crude Protein	Total Protein [g/100g]	Total Fat [g/ 100g]	Moisture Content [g/100g]
Foxtail millet	ATL1	59.4	58.2	17.9	82.1	4.1	11.125	9.600	2.31	10.96
	CO (Te) 7	60.9	59.3	17.4	82.6	4.2	11.750	10.350	2.50	8.33
Kodo millet [Varagu]	CO 3	64.8	62.5	24.1	75.9	4.6	11.375	10.080	3.77	8.55
	TNAU 86	66.2	64.0	24.3	75.7	4.7	11.188	9.958	4.35	8.61
Little millet	CO 4 (samai)	69.8	68.0	18.3	81.7	4.4	7.688	7.000	4.42	9.96
	ATL1	71.2	69.2	18.5	81.5	4.5	6.688	5.940	5.19	9.02
Barnyard millet	MDU 1	63.8	62.0	29.0	71.0	5.0	11.375	10.500	3.60	8.73
	CO 2 (KV)	64.4	62.5	29.3	70.7	5.3	11.250	10.200	3.90	8.70
Proso millet [Pani varagu]	ATL 1	67.5	65.7	27.7	72.3	3.9	12.200	11.000	3.63	11.42
	CO 5 (PV)	67.1	65.2	28.0	72.0	3.7	12.800	10.400	4.25	10.71
Statistical Analysis	SEm	0.110	0.150	0.085	0.083	0.080	0.328	0.1676	0.088	0.010
	SEd	0.155	0.211	0.122	0.118	0.113	0.463	0.2371	0.125	0.014
	CD (1%)	0.429	0.583	0.334	0.324	0.310	1.277	0.6534	0.346	0.040
	CD (5%)	0.318	0.432	0.248	0.241	0.230	0.947	0.4849	0.257	0.029

Where, SEm: Standard Error Mean, SEd: Standard Error Deviation, CD: Critical Difference.

Nutritional composition of Little millet in per 100gm is 7% Protein in CO 4 at 9.96 % moisture content. The percentage of non-protein nitrogenous compounds in little millet is approximately found to be 1.7%, Total fat recorded as 4.42% and 5.19% in CO 4 and ATL1 variety respectively. ATL1 variety has recorded 71.2% Total carbohydrate, 18.5% Amylose and 4.5% Resistant starch, 78µg Total carotenoids, 4.5 mg, Total flavonoids where as 9.63 mg, Total phenols is recorded by CO 4 (Table 1 and 2).

Nutritional composition of Barnyard millet in per 100gm is MDU1 has recorded 10.5%, Protein [11.38% Crude protein] with moisture content, 8.73%. Barnyard millet, CO 2 variety has recorded 3.9%, Total fat, 64.4%, Total carbohydrate 5.3%, Resistant starch 29.3%, Amylose 45µg, Total carotenoids 14.4 mg, Total phenols 6.78 mg, Total flavonoids 1.1 mg Tannin content and 35mg Phytic acid content (Table 1 and 2).

Nutritional composition of Proso millet in per 100gm in variety ATL1 has recorded 11% Protein, 12.2% Crude protein 11.42%, moisture content 67.5%, Total carbohydrate 3.9%, Resistant starch and has recorded lesser amount tannin content, 0.06mg. Proso millet, CO 5 variety has recorded 4.25% Total fat, 28.0% Amylose 366µg, Total carotenoids, 4.8 mg Total phenols, 1.62 mg Total flavonoids and 26mg Phytic acid content (Table 1 and 2).

Small millets are considered as nutri-cereals because of nutritional richness and are grown in various locations like plains and hills as well as in diverse soils and varying rainfall condition. In general, millets are less prone to major pests and diseases. Tamil Nadu people majorly like Potato, Tamarind and Maida rather than food sources having more biochemical value. Finger millet is usually consumed monthly once. Barn yard millets and kodo millets were consumed yearly thrice, Foxtail millet and Little millet were consumed yearly twice in many districts of Tamil Nadu. Food expenditure pattern is majorly on rice, pulses, milk, milk related products and moderate expenditure is on fruits and vegetables [inclusive of leafy vegetables]. Food expenditure on millets is seems to be minimum. The millet recipes could be designed with supplementation of legumes.

Starch is the principal carbohydrate in small millets. Little millet, variety ATL1 has recorded the highest starch content (69.2%) at moisture content 9% among the millets tested. Starch is a macromolecule which consists of several glucose units joined by alpha (1→4) and alpha (1→6) glycosidic linkages. Rapidly digestible starch, slowly digestible starch and Resistant starch were considered as three parts of whole starch molecule. Resistant starch resists digestion in the small intestine and may undergo fermentation to produce the derivatives. Resistant starch sources enhance the health of senior citizens by preventing colon cancer and bowel inflammation diseases. Resistant starch oriented foods increase the use of stored fat and thereby improve the fat catabolism especially people with more than 100kg weight.

Proso millet, ATL 1 has recorded the highest percentage of crude protein i.e. 12.2% and total protein 11.0% at moisture content 11.42% among the millets tested. The predominant protein in millet is prolamin and the remaining protein albumin, globulin and glutelin were present in varying proportions. The predominant amino acid of proso millet is glutamic acid [Non-essential; acidic amino acid]. Lysine contributes 2 to 2.2 g/100g protein in foxtail millet and proso millet whereas 3 g/100g protein in Kodo millet.

Food sources having the protein percentage more than 10 and the resistant starch percentage more than 5 are highly appreciable. Food sources having the Glycemic index lesser than 25 is also got attention by diabetes mellitus patients. One of the reasons behind of persons having diabetes mellitus is unhealthy diet.

Phenolic compounds are the important groups of secondary metabolites. Phenolic compounds are rich in peripheral layers of millets and also important factors in determining flavor, taste and color. We are supposed to consume phenolic compounds at least 1g/day through dietary sources because of their health promoting properties. Phenolic compounds acts as non-vitamin antioxidant as well as non-enzyme antioxidants for nullifying the harmful effects of free radicals. Phenolic compounds keep us young and cancer free. The predominant phenolic compound of minor millets is ferulic acid. Chlorogenic acid has high binding affinity towards hyperglycemic enzymes like alpha-amylase and alpha-glucosidase. Flavonoids are the sub classification of phenolic compounds. Salt affected soils like salinity and sodicity will affect the Total flavonoid content. Flavonoids play critical role in frost tolerance. Soil mineral nutrition like nitrogen and phosphorus will also affect the flavonoid content. In plants, flavonoids are synthesized to counter the excess ROS. Flavonoid oriented millet like Barnyard millet will counter the excess ROS in human when it is consumed frequently along with antioxidant vitamin rich dietary sources. Quercetin and kaempferol are important compounds.

The Proso millet grain, CO 5 is also a good source of carotenoids, one among that is beta-carotene.

Small millets provide a considerable amount of cofactors like zinc, magnesium, copper and iron which are reduced by milling. The mineral composition of selected minor millet flour were shown in (Table 3) and it indicates, Foxtail millets are rich in phosphorus 285mg/100g [CO (Te)7] and copper 2.4mg/100g [CO (Te7)], Kodo millet is rich in calcium 32mg/100g [TNAU 86], Little millet is rich in iron 9.0mg/100g [ATL1], Proso millets are rich in sodium 7.8mg/100g [CO 5 (PV)]and magnesium 158mg/100g [ATL1] and lesser in chromium 0.015mg/100g [ATL1].

Phosphorus is the essential element for many high energy compounds like ATP and GTP. The phosphorus content in foxtail millet CO (Te)7 is 285 mg/100g.

Actually, calcium is meant by finger millet (345 mg/100g). Calcium content in kodo millet (TNAU 86) is 32 mg/100g which is four times of rice (8mg/100g) and nearly one tenth of finger millet. In general, people prevent or treat calcium deficiency by calcium tablets such as calcium lactate which may leads to constipation. Calcium from milk source and plant sources are safer option. Recipes with combination of finger millet and kodo millet may reduce the calcium related osteoporosis. Calcium is required for nerve impulses and neuromuscular excitability.

Proso millet, variety CO 5 has recorded highest sodium 7.8 mg/100g whereas variety ATL1 has recorded highest magnesium 158 mg/100g. Oxidative phosphorylation process will be affected due to the absence of magnesium.

Iron act as a carrier of oxygen from lungs to tissues by haemoglobin. Iron is required for cytochrome assisted biochemical functions. Iron deficiency may leads to decrease in immunity and learning capacity. Little millet [ATL1] has recorded 9 mg/100g.

Copper is the important component for many enzymes associated with redox system.

Zinc plays a vital role in formation of chloroplast organelle and production of auxin hormone. Zinc is usually taken by the humans to enhance the immunity against viruses. Little millet [ATL1] has recorded 3.9 mg/100g.

The content of Total chromium in the test samples was low and was found in the range of 0.015 mg/100g to 0.080 mg/100g. Chromium element is distributed in water, soil and rocks. Trivalent chromium is considered as essential trace element for humans. Chromium contributes in metabolism of primary macromolecules whereas hexavalent chromium considered as toxic. Fruits and milk are considered as poor sources for chromium when compare to vegetables and cereals. The upper limit for chromium supplementation for adults may be 240µg/day.

Anti-nutritional factors of selected minor millets. Anti-nutritional factors of selected minor millets were shown in Table 2. Tannin belong to phenolic compounds category is responsible for astringent taste of the millet grain and makes superior when compare to rice and wheat. Tannin possess dual role as antinutritional, decrease the digestibility property of major primary metabolites and nutritional, since protects the gastrointestinal system.

Phytic acid is the major source of phosphorus and seed is the major source for phytic acid. Phytic acid may interfere with the absorption of selected divalent cations. Therefore, it is referred as an antinutrient. We need not worry about the phytic acid in dietary sources when it is in acceptable limit. Quantity of phytic acid will be decreased after germination of seed. The content of phytic acid in millets is 50% when compare to the content of phytic acid in wheat. On the other hand, the content of phytic acid in millets is found to be 1.5 to 3.0 times greater than content of phytic acid in conventional rice.

General product and value added products of millets. The small millets like Barn yard millet and kodo millet can be used for making adai, dosai, idli, puttu, idiyappam, sweet paniyaram, halwa and kesari. Fermented millet food products, found to have reduced quantity of antinutronal factors and increased the antioxidant potential. Barn yard millet and Kodo millet can be combined with Black gram and Fenugreek for the fermented product preparation of recipe Appam which would be liked by Kerala people. The recipe, kodo millet upma is nutritious and delicious for south Indians, when it is prepared with the vegetables like beans, carrots and onions. Panivaragu and Foxtail millet can be used for the preparation of pakota, suyyam and kozhukattai. Panivaragu flour can be used for the preparation of Ribbon pakoda. Foxtail millet can be used for the preparation of omapodi, vadagam and nutritious ball. Multi millet murukku can be prepared and provided as evening snacks for students. Maida can be replaced by small millets in many recipes. Thus, we can develop attractive and healthy based millet products suitable for home and commercial purpose.

Table 2: Nutritional and Antinutritional Profile of selected minor millets at fresh weight basis [Unpolished].

Name of the millet	Variety	Total Carotenoids [µg/100g]	Total Phenols [mg/ 100g]	Total Flavonoids [mg/100g]	Tannin content [mg/100g]	Phytic acid content [mg/100g]
Foxtail millet	ATL1	180	3.60	2.667	0.667	45
	CO (Te) 7	170	2.50	1.65	0.412	44
Kodo millet [Varagu]	CO 3	255	9.70	4.0	0.50	34
	TNAU 86	273	10.40	4.6	0.53	33
Little millet	CO 4 (samai)	69	9.63	4.50	0.45	24
	ATL1	78	9.54	4.32	0.43	23
Barnyard millet	MDU 1	36	14.40	6.78	1.30	36
	CO 2 (KV)	45	14.10	6.54	1.10	35
Proso millet [Pani varagu]	ATL 1	342	4.10	1.34	0.06	25
	CO5 (PV)	366	4.80	1.62	0.15	26
Statistical Analysis	SEm	4.62	0.075	0.1340	0.030	0.796
	SEd	6.54	0.106	0.1896	0.042	1.126
	CD (1%)	18.02	0.292	0.5225	0.118	3.102
	CD (5%)	13.37	0.216	0.3877	0.087	2.302

Where, SEm: Standard Error Mean, SEd: Standard Error Deviation, CD: Critical Difference.

Table 3: Mineral Profile of selected minor millets at fresh weight basis [Unpolished].

Name of the millet	Variety	Calcium [mg/ 100g]	Phos phorus [mg/ 100g]	Sodium [mg/ 100g]	Magne sium [mg/ 100g]	Iron [mg/ 100g]	Copper [mg/ 100g]	Zinc [mg/ 100g]	Chromium [mg/ 100g]
Foxtail millet	ATL1	24	270	2.5	80	2.3	1.4	0.8	0.025
	CO (Te) 7	27	285	3.0	88	2.7	2.4	2.1	0.030
Kodo millet [Varagu]	CO 3	28	190	4.0	148	0.5	1.4	1.2	0.020
	TNAU 86	32	185	3.5	144	0.3	0.5	0.9	0.025
Little millet	CO 4 (samai)	15	222	6.5	131	8.4	0.5	3.2	0.025
	ATL1	18	216	6.9	135	9.0	0.9	3.9	0.030
Barnyard millet	MDU 1	16	266	1.0	84	4.8	0.6	2.7	0.075
	CO 2 (KV)	21	273	0.5	90	4.5	0.5	2.5	0.080
Proso millet [Pani varagu]	ATL 1	15	203	7.3	158	0.7	1.6	1.4	0.015
	CO 5 (PV)	12	207	7.8	150	0.9	1.8	1.7	0.020
Statistical Analysis	SEm	0.730	1.461	0.128	1.155	0.112	0.058	0.100	0.0024
	SEd	1.033	2.066	0.181	1.633	0.159	0.082	0.141	0.0034
	CD (1%)	2.847	5.694	0.499	4.501	0.437	0.225	0.390	0.0094
	CD (5%)	2.112	4.225	0.371	3.340	0.324	0.167	0.289	0.0070

Where, SEm: Standard Error Mean, SEd: Standard Error Deviation, CD: Critical Difference.

CONCLUSIONS

There was a significant variation in the nutritional and antinutritional profile of selected minor millets. Variation in levels of Biochemical traits in minor millets is due to their nature and also based on the genotypes.The overall results of this study revealed that Proso millet, variety ATL 1and Barn yard millet, varieties CO 2 and MDU1 were considered as top three minor millets among the tested sources. Millets can be used as delicious and medicinal food. Barn yard millet and Kodo millet are considered as top two millets based on consumer preferences. Millets are considered as good sources for revenue. Millet grain is now receiving more attention from biochemists, nutritionists and patients. If hundred reasons are there for hundred years for a person life period, then, millet may be the one.

FUTURE SCOPE

This study may become the route map for the budding scientists. Millets may become the farmer's choice of cultivation. Consumers will rethink or reconsider their future options in selecting cereal grains as sources for routine and value added food products because of the appreciation of biochemical constituents. As millets improve fat catabolism, it may be included in the body fat reduction therapies.

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Conflict of Interest. None.

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