

Study of Biological Active Factors in Some New Varieties of Minor Millet Seeds

Sangeeta Gupta

Department of Applied Chemistry, Jabalpur Engineering College, Jabalpur-482011(M.P.) INDIA

S.K. Shrivastava

Department of Chemistry Govt. M.H. College of Home Science & Science for Women Jabalpur (M.P.) India

Manjul Shrivastava

Department of Chemistry Govt. M.H. College of Home Science & Science for Women Jabalpur (M.P.) India

Abstract - Minor millets are important source of protein in many developing countries. However this protein is not readily available because of biological active factors (anti-nutrients), hence information on the content of anti-nutrients is necessary, before including these seeds in diet. The biological active factors like polyphenol (tannins), oxalates, trypsin inhibitor activity, cynogenetics glycosides and heamagglutinin activities were studied in the varieties of minor millet seeds, viz Eleusine coracana (varieties FM & HR), Paspalum scrobiculatum (varieties 41,48 & 493), Panicum sumatrnse (varieties 8 & LMCO-2), Echinochloa frumentacea (varieties BMVL-29 & BMVL-172).

Key Words: Minor millets, biological active (anti-nutritive) factors, varieties of Eleusine coracana, Paspalum scrobiculatum , Panicum sumatrnse , Echinochloa frumentacea.

I. INTRODUCTION

Cereals are the staple diet of most of the world's population. Millets are a group of small-seeded species of cereal crops or grain like food that has been used by large group of people in rural, tribal and hilly areas in Asia and Africa [1-4]. It plays a very important role in the agriculture and food of many developing countries because of its ability to grow under adverse and limited rainfall conditions. It was reported that minor millet has many nutritious and medical functions. However, it must be pointed out that, millets also contains some anti-nutritional factors which inhibits proteolytic and amyolytic enzymes, protein and starch digestibility and makes poor human bioavailability of proteins[5]. Although numerous toxic compounds are found in minor millets including tannin, trypsin inhibitor activity, cynogenetic glycosides, oxalates and haemagglutinin activity. Since the toxic principles associated with the seed under investigation are not known, attempts are made to evaluate them.

Anti-nutritional factors are those substances generated in natural feed stuffs by the normal metabolism of species and by different mechanisms. Which exerts effect contrary to optimum nutrition [6]. These substance found in most foods and they are poisonous and they are protecting them-selves from being eaten. Since anti-nutrient occur in small quantities that they cause no harm [7]. Anti-nutritional factors are mainly organic compounds which when present in a diet, may affect the health of the animal or interfere with normal feed utilization. They occur as natural constituents of plant and animal feeds, as artificial factors, added during processing or as contaminants of the ecosystem[8]. Antinutritional factors (ANFs) in feed stuffs are classified according to chemical nature and their activity in animals as chemical natures, in this category are acids, enzymes, nitrogenous compounds, saponins, tannins, glycosinolates and phenolic compounds. Factor interfering with the digestion, utilization and availability of minerals of dietary proteins and carbohydrates, are tannins, trypsin or protease inhibitors, saponins and haemagglutinin, phytates or phytic acid, oxalates or oxalic, glucosinolates and gossypol[9]. Cynaogenic glycosides are widely distributed among 100 families of flowering plants and they are also found in some living micro organism[10-11]. Protein sources of plant origin containing high amount of tannins and in particular hydrolysable tannins should be used with caution [12]. Recent research has indicated that condensed tannins in low concentrations have beneficial effect in animal and human nutrition and health [13-14]. Trypsin inhibitors when ingested by man in large quantity disrupt the digestive process and lead to undesirable physiological reaction [15]. This biological active factors reduces the availability of nutrients of seeds. Thus it is necessary to determine the toxicity of the seeds sample included in the dietary system.

II. MATERIAL AND METHODS

New hybrid, authentic, healthy and matured seeds of minor millets variety Eleusine coracana (varieties HR & FM), Paspalum scrobiculatum (varieties 41, 48 & 493), Panicum sumatrense (varieties 8 & LMCO-2), Echinochloa frumentacea (varieties BMVL-29 & BMVL-172) under investigation were procured from Agriculture Research Station Dindori (M.P.), a regional extension of Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (M.P.).

The seeds were studied for their tannin content, oxalate content, trypsin inhibitor activity, cyanide content and haemagglutinin activity. Cyanide and tannin contents of seeds were determined by the method of AOAC (1970) [16]. The total oxalate content in the form of oxalic acid was determined by using the method of Talpatra et al., (1948) [17]. Trypsin inhibitor activity was determined according to the method as described by Kakade et al. (1969) [18] with certain modifications by Gupta and Deodhar (1975) [19]. Haemagglutinin activity was determined by the method as given by Liener (1955) [21].

TABLE-1 ANTI NUTRIENTS AND MINOR MILLETS (g/100 g)

Name of Variety	Tannin content	Oxalate content	Trypsin inhibitor activity	Cyanide content	Haemagglutinin Activity		
					Human Blood	Goat Blood	Hen Blood
Eleusine coracana-FM	0.252	0.0225	23.0	ND	ND	ND	ND
Eleusine coracana-HR	0.253	0.0211	26.9	ND	ND	ND	ND
Paspalum scrobiculatum 41	0.400	0.0521	12.1	ND	ND	ND	ND
Paspalum scrobiculatum-48	0.420	0.0525	1.4	ND	ND	ND	ND
Paspalum scrobiculatum-493	0.401	0.0522	21.0	ND	ND	ND	ND
Panicum sumatrense-8	0.504	0.0262	11.5	ND	ND	ND	ND
Panicum sumatrense- LMCO 2	0.502	0.0241	13.6	ND	ND	ND	ND
Echinochloa frumentacea BMVL-29	0.301	0.0202	31.95	ND	ND	ND	ND
Echinochloa frumentacea BMVL-172	0.302	0.0204	ND	ND	ND	ND	ND

ND- not detected.

III. RESULTS AND DISCUSSION

The result of biological active factors of the minor millet seeds are shown in Table 1. The tannin content of different varieties of minor millet seeds ranged from 0.252 -0.504gm/100g. These values are lower than the earlier findings of Pasala et al., (1989)[21] and are well below the fatal dose [22].

The total oxalate content (in terms of oxalic acid) was found to be maximum (0.0525g/100g) in the variety of Paspalum scrobiculatum-48 while it was minimum (0.0202g/100g) in the variety of Echinochloa frumentacea BMVL-29. The results were in good proximity with other varieties of Ragi, Kutki and Kodo as reported earlier by Ravindran, Hadimani and Malleshi 1993; Ramachandra et al. 1977 [23-25]. All the values of oxalates were found to be less than the fatal dose [22].

The Trypsin inhibitor activity of minor millet seeds varied from 1.4-31.95mg/100g. However no trypsin inhibitor activity was reported in the variety Echinochloa frumentacea BMVL-172.

No Cyanide content and haemagglutinin activity were found in the varieties of minor millet seeds under study. The value of anti nutritional factors reported in the present study was lies within the lethal dose[22].

IV. CONCLUSION

Most of the anti nutritional factors are heat-labile and since only humans consume millets after cooking, it would not constitute any major health hazard. In the other animal feed or compositions soaking and roasting for limited period would be beneficial to increase the nutritional quality of the feed and the extent of the anti nutritional may be reduced. Heat stable compounds such as polyphenols are not easily removed by simple soaking and heating however the values reported in the present study were well in the limit[22]. These could may be reduced by germination or fermentation. It is now established that phytates, polyphenols and tannins can contribute to antioxidant activity of the millet foods, which is an important factor in health, aging and metabolic diseases [26].

REFERENCES

- [1] Ravindra et al., *Tropical Agric. Research* Vol.20, pp.115-122,2008.
- [2] Anonymous, QRT report of millets, Director of millets development, Rajasthan, 2006.
- [3] B.R. Rao et al., "Evaluation of nutritive properties of selected small millets", *J Pharm Bioall Sci* vol.277-9, 2011.
- [4] S.A. odoemalam, Osu, CI, "Evaluation of the phytochemical content of some edible grains marketed in Nigeria" *E J chem.* vol.6, pp. 1193-9, 2009.
- [5] P.M. Chilkawar, R.V. Salve, and Hashmi, Syed Imran, "Studies on standardization of malting process for finger millet (ragi)", *Internat. J. Proc. & Post Harvest Technol.*, vol.1 (2), pp. 81-86, 2010.
- [6] K.E. Akande, U.D. Doma, H.O. Agu and H.M. Adamu, "Major Anti-nutrients found in plant protein sources, Their Effect on Nutrition", *Pakistan Journal of Nutrition*, vol.9(8), pp.827-832, 2010.
- [7] Farzana Panhwar, Antinutritional factors in oil seeds as aflatoxin in ground nut. Digitalverlag GmbH, Germany, (2005)1-7.
- [8] A.R. Barnes, and W.K. Amega, "Utilization of cocoa pod husk meat by growing finishing pigs. Proc". 9th International coca research conference, Lome, Togo, pp.449-454, 1984.
- [9] P. Nityanand, Text book of Feed Processing Technology. Vikas Publishing House PVT Ltd., New Dehli, India, 1997.
- [10] J.B. Harborne, "Cyanogenic glucosides and their functions". In: Phytochemical ecology. Academic Press, London, pp.104-123, 1972.
- [11] J.B. Harborne, "plant toxins and their effects on animals". In: Introduction to Ecological Biochemistry. Academic Press, London, pp. 71-103, 1993.
- [12] K. Becker and H.P.S. Makkar, "Effects of dietary tannic acid and quebracho tannin on growth Performance and metabolic rates of common carp. Aquaculture", vol. 175, pp.327-335, 1999.
- [13] D.L.J. Freed, "Lectins in food: their importance in health and disease", *J. Nutritional Med.* vol.2(1), pp.45- 64, 1991.
- [14] J. Huisman and G.H. Tolman, "Anti-nutritional factors in the plants proteins of diets for non-ruminants". In P.C. Garn worthy, W. Haresign and D.G.A. Cole (Eds), Recent Advances In Animal Nutrition. Butler worth Heinemann Ltd, Oxford (UK), pp.3-31, 1992.
- [15] A. N. Booth, D.J. Robbins, and W.F. Kibellin, "Effect of raw soyabean meal on Pancreatic hypertrophy in rats". *Proc. Soc. Expt. Biol. Med.* vol.104, pp.68-72, 1960.
- [16] AOAC, Official Method of Analysis, Washington D.C., pp. 240, 438 (1970).
- [17] S.K. Talpatra, S.C. Roy and K.C. Sen, *Indian J. Vet. Sci. Anim. Husb.*, vol.18, pp. 99 1948.
- [18] M.L. Kakade, N.R. Simsons and I.E. Liener, *Cereal Chemistry*, vol.46, pp.518-526, 1969.
- [19] A.K. Gupta and A.D. Deodhar, *Indian Journal of Nutrition and Dietetics*, vol. 12(3), pp.81-84, 1975.
- [20] I.E. Linear, *Archives Biochemistry and Biophysics*, vol.54, pp. 223, 1955.
- [21] Pasala Geervani and Bjorn O. Eggum, "Nutrient composition and protein quality of minor millets". *Plant Foods for Human Nutrition*, vol.39, pp.201-208, 1989.
- [22] Sarjekar, P. Saxena and S.K. Shrivasta, *Ann. plant. Physiol.*, 8, 198(1994).
- [23] G. Ravindran, "Studies on millets: Proximate composition, mineral, phytate and oxalate contents". *Food Chem.* Vol.39, pp. 99 – 107, 1991.
- [24] N.A. Hadimani, N.G. Malleshi, "Studies on milling, physicochemical properties, nutrient composition and Dietary fiber content of millets". *J Food Sci Technol* vol.30, pp .17–20, 1993
- [25] G. Ramachandra, T.K. Virupaksha, and M. Shadaksharaswamy, "Relationship between tannin levels and in vitro protein digestibility in finger millet (*Eleusine coracana* Gaertn)". *J Agric Food Chem*, vol.25, Pp.1101–1104, 1977.
- [26] L. Bravo, "Polyphenols: chemistry, dietary sources, metabolism and nutritional significance". *Nutr Rev* vol.56, pp.317–333, 1998.