Millets: Comparison with other Major Staple Foods

D. B. Prajapati
Associate Research Scientist and Unit Head, Agricultural Research Station, Anand Agricultural University, Sansoli-387130, Kheda (Gujarat)
Corresponding Author: dbprajapati207@gmail.com

Introduction

Millets are a storehouse of most of the nutrients required for the normal functioning of the human body. These crops are rich in micronutrients and minerals, four to five times more than others. The millets are essential for nutritional security due to the high number of amino acids. Most importantly, millets stand out from other cereal crops due to their low to zero gluten content and glycemic index.

After the Green Revolution, over-reliance on common cereals and sedentary lifestyles have led to an increase in health-related diseases such as obesity, diabetes, coronary diseases, gastrointestinal disorders and the risk of colon, breast and esophageal cancer. Being rich in fibre, antioxidants, minerals, phytochemicals, polyphenols and proteins, millets act like an elixir to fight health-related disorders. These crops improve digestion due to their high fibre content. It keeps the mind calm, relieves problems like depression, stress and insomnia. Millets contain tryptophan, an amino acid that makes the stomach feel full so that hunger is not felt for longer. Thus, it proves to help for prevent weight grain. Boon for pregnant women due to its high calcium and iron content. Most importantly, the quality of protein in these crops can be a good for diabetes, high blood pressure and heart disease patients due to their gluten-free and low glycemic index.

Millets are generally known as ancient heritage grains grown in chemical-free light soils. High amounts of micronutrients and fibres gluten-free protein nature, resistant starch properties and various phytochemicals help boost immunity. So, these crops are often called miracle grains.

Table 1 Nutrient content in various millets per 100g

Component	Cassava	Wheat	Rice	Sweet corn	Potato	Sorghum Millet	Proso Millet
Water (g)	60	13.1	12	76	82	9.2	8.7
Energy (kJ)	667	1368	1527	360	288	1418	1582
Protein (g)	1.4	12.6	7	3	1.7	11.3	11
Fat (g)	0.3	1.5	1	1	0.1	3.3	4.2
Carbohydrates (g)	38	71.2	79	19	16	75	73
Fiber (g)	1.8	1.2	1.0	3.0	2.4	3.3	8.5
Sugars (g)	1.7	0.4	>0.1	3	1.2	1.9	-
Iron (mg)	0.27	3.2	0.8	0.5	0.5	4.4	3
Manganese (mg)	0.4	3.9	1.1	0.2	0.1	<0.1	1.6
Calcium (mg)	16	29	28	2	9	28	8
Magnesium (mg)	21	126	25	37	21	<120	114
Phosphorus (mg)	27	288	115	89	62	287	285
Potassium (mg)	271	363	115	270	407	350	195
Zinc (mg)	0.3	2.6	1.1	0.5	0.3	<1	1.7
Pantothenicacid(mg)	0.1	0.9	1.0	0.7	0.3	<0.9	0.8
Vitb6 (mg)	0.1	0.3	0.2	0.1	0.2	<0.3	0.4
Folate (µg)	27	38	8	42	18	<25	85
Thiamin (mg)	0.1	0.38	0.1	0.2	0.1	0.2	0.4
Riboflavin (mg)	<0.1	0.1	>0.1	0.1	>0.1	0.1	0.3
Niacin (mg)	0.9	5.5	1.6	1.8	1.1	2.9	4.7

Table 2 Nutrient Content of Various Millets with comparison to Rice and Wheat g/100g

Crop /Nutrient	Protein(g)	Fiber(g)	Minerals (g)	Iron(mg)	Calcium(mg)
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8.0	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9.0	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41
Sorghum	10.23	1.3	1.9	2.4	25

Table 3 Essential amino acid composition (mg/g) and chemical score of sorghum and millet proteins

Grain	Isoleucine	Leucine	Lysine	Methi-onine	Cystine	Pheny-lalanina	Tyrosine	Threonine	Tryptophan	Valine	Chemical score
Sorghum	245	832	126	87	94	306	167	189	63	313	37
Pearl millet	256	598	214	154	148	301	203	241	122	345	63
Finger millet	275	594	181	194	163	325	-	263	191	413	52
Foxtail millet	475	1 044	138	175	-	419	-	194	61	431	41
Common millet	405	762	189	160	-	307	-	147	49	407	56
Little millet	416	679	114	142	-	297	-	212	35	379	33
Barnyard millet	288	725	106	133	175	362	150	231	63	388	31
Kodo millet	188	419	188	94	-	375	213	194	38	238	55

Indian diets derive almost 60 % of their protein from cereals with relatively low digestibility and quality. There have been several surveys of diets and protein intakes in India by the National Nutrition Monitoring Board (NNMB) over the last 25 years, in urban and rural, as well as in slum dwellers and tribal populations. Data of disadvantaged populations from slums, tribals and sedentary rural Indian populations show that the protein intake (mainly from cereals) is about 1 gm/kg/day. However, the protein intake looks less promising in terms of the protein digestibility corrected amino acid score (PDCAAS), using lysine as the first limiting amino acid, where all populations, particularly rural and tribal, appear to have an inadequate quality to their protein intake. The protein: energy (PE) ratio is a measure of dietary quality, and has been used in the 2007 WHO/FAO/UNU report to define reference requirement values with which the adequacy of diets can be evaluated in terms of a protein quality corrected PE ratio. It is likely that about one third of this sedentary rural population is at risk of not meeting their requirements. These levels of risk of deficiency are in a population with relatively low BMI populations, whose diets are also inadequate in fruits and vegetables. Therefore, while the burden of

enhancing the quality of protein intake in rural India exists, the quality of the diet, in general, represents a challenge that must be met (Sumathi *et al*. 2012).

The amino acid score calculation indicates the ratio of amino acids present in food. By using an amino acid score, it can be indicated if a protein will meet all amino acid needs of the body. If the amino acid score meets the required score, it will be a completed or ideal protein. To calculate the amino acid, score the formula used is, the milligram of limiting amino acid in 1 gram of test protein/ the milligram of that same amino acid of reference protein multiplied by 100. If food has a score of 100 it is to consider as a high-quality protein with all the necessary nutrients (https://en.wikipedia.org/wiki/Amino_acid_score). Pearl millet, like sorghum, is generally 9 to 13 percent protein, but large variations in protein content, from 6 to 26 percent, have been observed. (Serna Saldivar, McDonough and Rooney, 1991). Lysine is the first limiting amino acid of pearl millet protein.

Within the Indian context, small millets have great potential as a healthy food to address this challenge by the virtue of their nutritional qualities. However, there are many problems with the current processing technology for small millets, whereas the use of value-added products was minimal. To demonstrate the health benefits of consuming value-added small millets, a study of supplementation of multi-millet health mix on the nutritional status of primary schoolchildren was conducted in Thondamuthur Block of Coimbatore District, India. Multi-millet health mix was formulated from kodo millet, little millet, foxtail millet, finger millet, and wheat with the inclusion of pulses. It contained 65.45-g carbohydrate, 11.46-g protein, 4.94-g fat, 4.94-g fibre, 4.07-mg iron, 112-mg calcium, 268.52-mg phosphorus, and 349 calories of energy per 100 g. The study indicated that there was a significant increase in height, weight, and haemoglobin level of the schoolchildren who regularly consumed the formulated multi-millet health mix. The improved huller and value-added food product developed can be feasible options for improving nutrition security and livelihoods through increased use of small millets.

Conclusion

The proportion of individuals at risk of a deficient protein intake is high in rural and tribal adult populations, this occurs against a backdrop of a high prevalence of low BMI, sometimes to an extent of 50% (National Nutrition Monitoring Bureau 2000). This is a big burden in disadvantaged populations; it is not simply the burden of enhancing the quality of protein intake but also the quality of the diet in general, and represents a severe challenge that needs to be met. Small millets have great potential as a healthy food to address this challenge by the virtue of their nutritional qualities. Ulti-millet health mix was formulated from Kodo millet, little millet, foxtail millet, finger millet, and wheat with the inclusion of pulses.

References

Amino Acid Calculation: https://en.wikipedia.org/wiki/Amino_acid_score.

Casey and Lorenz (1977). P. Casey, K. Lorenz. Millet—Functional and nutritional properties. Bakers Digest., 51 (1977), p. 45.

Malathi Durairaj, Gurumeenakshi Gurumurthy, Varadharaju Nachimuthu, Karthikeya, Muniappan, Subbulakshmi Balasubramanian (2019). Dehulled small millets: The promising nutria cereals for improving the nutrition of children. https://onlinelibrary.wileycom/toc/17408709/2019/15/S3.

National Nutrition Monitoring Bureau (2000). Diet and nutritional status of tribal population: Report on first repeat survey. NNMB Technical Report No 19. Hyderabad: NIN, ICMR.

Serna-Saldivar, S.O., McDonough, C.M. and Rooney, L.W. (1991). The millets, in Handbook of Cereal Science & Technology (eds Lorenz, K.J. and K. Kulp), Marcelo.

Sumathi Swaminathan, Mario Vaz and Anura V. Kurpad (2012). Protein intakes in India Eds. St John's Research Institute, Bangalore, India published in British Journal of Nutrition (2012), 108, Pp50–58.

* * * * * * * * *