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## **Nutri-cereals in human health under changing climate scenario**

**Sailabala Dei and AK Sinha**

### **Abstract**

Nutri-cereals are in fact the new nomenclature for millets or coarse cereals; these are the nutrient rich cereal crops generally grown in dry land regions and known as climate resilient crops. Under the changing climate scenario, nutri-cereals play an important role both in terms of their cultivation with low water requirement as well as providing nutritional securities to the deprived / under- privileged masses across the globe. Because of the abundance of nutrients -proteins, B-vitamins, calcium, magnesium. Iron, Zinc, potassium etc., their role in reducing Protein-Energy-Malnutrition, nutritional anaemia etc. and controlling blood sugar, blood pressure, G.I. disturbances etc. is very much recognised. Now, emphasis has been given by the Government to promote the production and consumption of nutri-cereals to deal with the climatic risks along with human health and diseases. The present study is an attempt to highlight the much needed nutritional role of nutri-cereals in human health & diseases under changing climate.

**Keywords:** Climate resilient crops, nutritional security, nutritional deficiency disorders, human health and diseases, under privileged masses

### **Introduction**

The new name of millets as nutri-cereals has come into use since year 2018 after the Indian Government declared the year as National Year of Millets. Generally, Millets are the traditional staple foods of dry land regions. But also grown on upland conditions in many regions of the country. The name nutri-cereals means they are highly nutritious and are known to have high nutrient contents which includes protein, essential fats, dietary fibre, B-vitamins, calcium, iron, potassium and magnesium. They help in rendering health benefits like reduction in blood sugar level, blood pressure regulation, thyroid, cardio-vascular and celiac diseases. However, the direct consumption of millets as food has significantly declined over the past four decades. Hence, it has now become imperative to re-orient the efforts on production and utilisation of millets so that appropriate demands are generated for value addition, nutrition evaluation and health benefits of human beings under the scenario of changing climate. In this context, a commendable step has been taken by the Government and the millet wing of the National Food Security Mission (NFSM) has been converted into Nutri-cereal Sub-Mission for the purpose of advancement of millets/nutri-cereals.

### **Concept**

Now, the previous concept of millets has been changed and given rise to the new concept; it has been brought into the Public Distribution System (PDS) of the country and also aimed at providing nutritional security to the vulnerable segment of the population.

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Previous	Present
Inferior to rice & wheat	superior to rice & wheat
Meant for food security	meant for nutritional security
Healthy	More healthy

### Top Millets under Nutri-cereals

#### Common names

1. Jowar
2. Bazra
3. Ragi
4. Kodo
5. Sanwa
6. Kutki
7. Cheena
8. Kangani

#### English names

- sorghum  
pearl millet  
finger millet  
kodo millet  
Barn yard millet  
little millet  
proso millet  
fox tail millet

### Major millets growing states

1. Telengana
2. Andhra Pradesh
3. Tamil Nadu
4. Kerala
5. Karnataka
6. Maharashtra
7. Gujrat
8. Haryana
9. Uttarakhand

10. Bihar (few pockets -Banka, Munger, Aurangabad, Jehanabad, Saharsa, Purnea, Araria etc.)

In India, the total area under millet production is around 17 - million hectares with 18-million metric tons production which contributes towards approx.10% of the country's food grain basket.

In spite of the area coverage and contribution as a food grain, the rapid urbanization and industrialisation had shifted the attention of consumers as well as farmers in favour of wheat &rice, but the gradual increasing trend of nutritional diseases and lifestyle disorders like diabetes, high cholesterol, migraines, heart attacks etc. have compelled the country to go for these super grains/nutri-cereals for a better health.

However, momentum is yet to be gained in the production, productivity and consumption pattern of people by taking care of the following weaknesses in the system.

1. Lack of awareness of the nutritional merits.
2. Inconveniences in food preparation
3. Lack of processing technologies.
4. Lack of Govt. policies for incentives.
5. Non-subsidised prices
6. Lack of promotion of popular dishes of millets.
7. Ignorance of its health benefits

### Nutritional Benefits of Millets

#### Nutritional aspects: Cereals vs Millets

**Table 1:** Nutritional aspects: Cereals vs Millets

Parameter	Protein (g)	Fat (g)	Mineral (g)	Total Dietary fibre (g)	Insoluble Dietary fibre (g)	Soluble Dietary fibre (g)	CHO (g)
Rice milled	7.94	0.52	0.60	1.81	1.99	0.82	78.20
Whole wheat	10.60	1.50	1.40	11.20	9.60	1.60	64.00
Finger millet	7.20	1.90	2.00	11.20	9.50	1.70	66.80
Proso	12.50	1.10	1.90	-	-	-	70.40
Foxtail	12.30	4.30	3.30	-	-	-	60.90
Little	10.40	3.90	1.30	7.70	5.50	2.30	65.60
Kodo	8.90	2.60	1.70	6.40	4.30	2.10	66.20
Barnyard	6.20	4.40	2.20	-	-	-	65.50
Pearl	11.00	5.40	1.40	11.50	9.10	2.30	61.80
Sorghum	10.00	1.70	1.40	10.20	8.50	1.70	67.70

Source: Nutritional and health benefits of millets-IIMR, ICAR, 2017

**Table 2:** Vitamin & minerals composition of millets (mg per 100 g edible portion)

Parameter	Finger	Proso	Foxtail	Little	Kodo	Pearl	Sorghum	Rice straw milled	Wheat
<b>Vitamins</b>									
Total carotenoids	1.54	-	32.00	120.00	272.0	293.0	212.0	16.90	287.0
Thiamine	0.37	0.20	0.59	0.26	0.29	0.33	0.35	0.05	0.45
Riboflavin	0.17	0.18	0.11	0.05	0.20	0.25	0.14	0.05	0.17
Niacin	1.34	2.30	3.20	1.29	1.49	2.30	2.10	1.69	5.50
<b>Minerals and trace elements</b>									
Calcium	364.0	14.00	31.00	16.06	15.57	42.00	27.60	7.49	41.0
Phosphorus	283.0	206.0	290.0	220.0	188.0	296.0	274.0	160.0	306.0
Iron	4.62	0.80	2.80	1.26	2.34	8.00	3.95	0.65	5.30
Magnesium	137.0	15.30	81.00	133.0	147.0	137.0	1.33	64.0	138.0
Sodium	11.00	8.20	4.60	8.10	4.60	10.00	5.42	-	17.10
Potassium	408.0	113.0	250.0	129.0	144.0	307.0	328.0	-	284.0
Copper	0.67	1.60	1.40	0.34	0.26	1.06	0.45	0.23	0.68
Zinc	2.30	1.40	2.40	3.70	0.70	3.10	1.96	1.30	2.70

Source: Nutritional and health benefits of millets-IIMR, ICAR, 2017

**Table 3:** Essential amino acids (mg/g N)

Parameters	Finger millet	Proso millet	Foxtail millet	Little millet	Kodo	Pearl millet	Sorghum	Rice (raw) millet	Wheat
Aginine	300	290	220	250	270	300	240	480	290
Histidine	130	110	130	120	120	140	160	130	130
Lysine	220	190	140	110	150	190	150	230	170
Tryptophan	100	050	060	060	50	110	70	080	070
Phenyl alanine	310	310	420	330	430	290	300	280	280
Tyrosine	220	-	-	-	-	200	180	290	180
Methionine	210	160	180	180	180	150	100	150	090
Cystine	140	-	100	090	110	110	090	90	140
Threonine	240	150	190	190	200	240	210	230	180
Leucine	690	760	1040	760	650	750	880	500	410
Isoleucine	400	410	480	370	360	260	270	300	220
Valine	480	410	430	350	410	330	340	380	280

**Table 4:** Available carbohydrate contents of Cereals Vs Millets

Grain	Available carbohydrate (g)	Amylose	Amylopectin	
Rice milled	76.4	12-19 (short grain)	81-88 (short grain)	<ul style="list-style-type: none"> <li>Available carbohydrate contents in millets are lower</li> <li>Proso, kodo and sorghum contains appreciable levels of amylase</li> </ul>
Wheat	59.3	25	75	
Finger	62.5	16	84	
Proso	-	28.2	71.8	
Foxtail	-	17.5	82.5	
Little	66.4	-	-	
Kodo	66.2	24	76	
Barnyard	-	-	-	
Pearl	56.0	21.1	78.9	
Sorghum	61.0	24	76	

**Source:** Nutritional and health benefits of millets- IMMR, ICAR, 2017

**Table 5:** Nutrient Composition of Finger Millet Based Products

Name of the sample	Protein%	Fat%	Ash%	Available CHO%	TDF%
Ragi	7.04	1.32	2.61	61.73	12.69
Partially decorticated Ragi (PDR)	6.66	0.90	1.41	74.39	5.82
Polished white rice* (PWR)	6.3	0.7	0.5	80.1	1
Ragi Flakes (RF)	7.2	1.21	1.91	62.68	12.30
White Rice Flakes (WRF)	9.87	0.84	1.02	73.56	1.08
Ragi Vermicelli (RV)	13.43	0.60	2.86	57.65	13.56
Maida Vermicelli (MV)	10.03	0.54	0.78	73.19	3.95
RTE Ragi snak (RS)	11.39	0.17	3.84	63.87	16.45
Commercial RTE snack (CS)	6.18	34.77	2.91	50.65	2.80
Partially Decorticated Ragi Upma	3.90	2.27	2.50	28.65	6.69
Ragi Flakes Upma (RFU)	4.22	2.00	2.11	22.96	7.89
Ragi Vermicelli Upma (RVU)	5.93	2.14	2.79	20.38	8.66

**Source:** Nutritional and health benefit of millets- IIMR, ICAR, 2017

### Health Benefits of Millets

- millets are anti-acidic
- millets are gluten free
- millets are detoxicants
- millets lower blood cholesterol
- prevent breast cancer
- prevents type-II diabetes
- protects against heart diseases
- helpful in asthma
- Reduces risks of G.I disturbances like constipation, excess gas, bloating or cramping.
- Acts as a probiotic feeding microflora in inner ecosystem.

### Phytochemicals in millets

Millets are having antioxidant effects in the body, those help in providing immunity and fight against diseases; the major phytochemicals found in millets are:

- More than 50-phenolic compounds (finger millets, proso & pearl millets)
- Phenolic acids and their derivatives (sorghum & finger millet)
- Flavonols & flavones (kodo & finger millet)
- Anthocyanins & condensed tannins etc. (all millets)

### Common millet products/dishes and their health benefits based on field researches.

Because of the multi-faceted benefits of millets in human health, efforts have been made to prepare various millet products to feed the population groups in an easy, palatable and nutritious manner; the various items made are in the form of biscuits, cakes, pastries, upama, uttapam, chapathi etc. They have also been used in diet therapy to treat the nutritional disorders like anaemia, Protein-Energy undernutrition, pallegra and calcium deficiency disorders. Dietary items made out of finger millets powder, in many

instances have been fed to the under five children, adolescent girls, pregnant and lactating women on regular basis and health benefits have been observed. In a pilot study on ' Role of ragi kheer in the treatment of nutritional anaemia in pregnant mothers" it has been found that ragi-kheer, an easy and convenient dish made out of finger millet powder/flour, has positively influenced the blood haemoglobin (Hb) level of pregnant mothers in the 1st trimester of their pregnancies. After regular consumption of ragi-kheer for three months, the percentage of mild and moderate anaemic mothers (78.8%) has come down to a significantly lower extent i.e., almost 5%, which is an encouraging impact of this super food or nutrient packet called ragi kheer.

In this regard, further studies are going on at field condition to assess the physical efficiency of farm-women being regularly fed with ragi-dishes and other nutri-cereal items.

Further, millets are also known to have low and moderate Glycemic Indices (G.I.) and therefore, considered important for therapeutic uses for persons suffering from blood sugar level irregularities, i.e., diabetes. The G.I. in fact is the relative ranking of carbohydrates in foods according to how they affect the blood glucose level; a low G.I. indicates that carbohydrates are slowly digested, absorbed, metabolised and cause a slower and lower rise in blood glucose and insulin.

Studies have also been conducted (ICAR-ICMR, 2015) to see the Glycemic Index (G.I) of finger millet products and found that nutri-cereal products have G.I.s as low as 55-65 , thereby highlighting the significance of these power packed good old grains as a super food in human health and diet.

### **Conclusion**

There is an urgent need to recognise the significance of the nutri-cereals in human health and diet. There is also a need to include different items of nutri-cereals in the diets of women and children during increasing demands of the body. The cultivation, utilisation and marketing of these nutri-cereals needs to be given priority by the Govt. sectors in the pattern of PDS already mentioned. Further, recent researches in University systems have also laid emphasis on millet improvement programmes, processing technology, value addition and area expansion so that farmers could reap remunerative prices and achieve prosperity through the production and processing of nutri-cereals, which would be definitely a successful venture for reducing risks to climate changes under the present scenario across the globe.

### **References**

1. Technical report of ICAR-ICMR,2017 on nutritional and health benefits of millets.
2. Address of Union Minister of Agriculture and Farmers' welfare on coarse cereals, 2018.
3. Research paper on" Role of ragi kheer in treating nutritional anaemia in pregnant women in Araria district, Bihar state" by Sailabala Dei & A.K. Sinha, presented in the International Conference on Global food security and reducing risks from climate change', held during at BHU, Varanasi, 2019