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Role of millets for enduring nutritional security

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Abstract
The Millets crop is an important component of the rainfed traditional cropping systems and provides significant contribution to food, fodder, health, nutritional and livelihood security for millions of families, especially the small/marginal farmers and the residents of rain fed/remote tribal areas. Millets requires, 2.5 times less water than rice, making it a sustainable crop due to its tolerance to high temperature (up to 46 degree centigrade) and soil salinity. Millet consumption in India has declined over the years due to change in governmental policies and dietary habits and drudgery in preparation. Hence, along with awareness about health benefits of millets, there is an urgent need for development of technology to make millet value added products.

Keywords: Millets, nutritional security, awareness, recipe contest

Introduction
Not much, just 50 years ago our food culture was completely different. We were people who ate millets. Millets means- Jowar, Bajra, Ragi (Madua), Sawan, Kodo and similar grains. During the Green Revolution in the 60s, we decorated wheat and rice in our plate and kept millets away from ourselves. We turned away from the grain which we were eating for six and a half thousand years and today the whole world is returning to the same millets.

It is called millets or coarse grain because it does not require much effort in its production. These grains also grow in less water and less fertile land. Compared to paddy and wheat, the consumption of water in the production of millet is very less. There is no need of urea and other chemicals in its cultivation. Therefore it is also better for the environment. The cultivation of jowar, bajra and ragi requires 30 percent less water than that of paddy. About 4,000 liters of water is consumed in the production of one kilo of paddy, while nominal water is consumed in the production of millet grains. They grow even in poor soil. These grains do not spoil quickly. They are edible even after 10 to 12 years. Thick rains also tolerate climate change. It is not affected by more or less rain. This is the reason why it is absolutely capable of providing continuous nutritional security even in the changing environment. The cultivation of millet grains also helps in reducing the carbon footprint which is a global problem today.

The advantages of cultivating these crops include drought tolerant, light-insensitive and adapted to climate change. These are generally fast-growing, early-maturing grains, ready for harvest plant in as little as 65 days, also well performed in marginal environments (Chaturvedi *et al.,* 2011) [1].

Moreover, millets contribute extensively to the food and nutrition security of the country. These are known as nutri-cereals which provides proper nutrition to the body which is usually not available from grains like wheat and paddy. Millets have an unique nutritional profile with significant amount of essential amino acids, high vitamin levels especially B vitamins, vitamin A, and micronutrients especially calcium, zinc, iron and phosporous (Obilana and Manyasa, 2002) [2]. Millets are highly nutritious, acid-free, gluten-free and have dietary properties. In addition, the consumption of these coarse cereals are very helpful in ending malnutrition in children and adolescents. Millets have a low glycemic index (GI) and are also helpful in the prevention of diabetes. Consumption of millet recipes for a period of 30 days significantly reduced the blood sugar level and also the diabetic symptoms (Mishra *et al.,* 2019) [3].

Despite these characteristics, in India millets are losing its pride in production and consumption. The situation warrants aggressive promotion of millet in view of increased recognition for their nutritional value among people. Due to the International Year of Millets, awareness about millet is being created among farmers and common citizens across the world. KVK, Sidhi has organized training and recipe contest in this direction.

Its main objective is to create awareness among the people about millets and to document the indigenous knowledge of women and make aware the local communities to conserve and solve food and nutrition problems. Millets in India are forgotten grains, which were forgotten by the farmers, now once again farmers are being made aware to grow these coarse grains in their fields, so that millets can come from the field to the common man's plate.

Materials and Methods

The present study was carried out in three blocks of Sidhi disrict of Madhya Pradesh *viz*. Chhavari village of Sidhi block, Gopalpur village of Rampur Naikin block and Thadipathar village of Kusmi block. A total of 150 respondents (50 from each village) were selected by using convenience sampling technique. A survey schedule was used for collection of primary data from individual respondent and about traditional formulation or preparation of millet based food items.

The millet recipe contests were initiated at the local level through a group meeting with Sarpanch, School Headmaster, aaganwadi worker and community members several days prior to each contest. On the day of the millet contest, the participating women brought the dishes to a central place. A jury consisting of Sarpanch, School head master, aaganwadi worker, knowledgeable and interested community members, and KVK staff was set-up to evaluate the participants. Sensory evaluation of each recipe was conducted on flavour, appearance, colour, texture, taste and overall acceptability by using five-point hedonic scale where 1 indicated being highly disliked and 5 being highly liked. The winners were awarded with prizes and certificate in a public gathering in the village. The winning recipes were displayed and shared with locals. The idea of organizing the recipe contest was to recognize and award knowledgeable women for their efforts in identifying, preserving, and adding the value to dishes.

Results and Discussion

Nutritional Composition of the Millets

The nutritional composition of the millets are presented in Table 1, it is compared with that of rice and wheat. The protein content of foxtail millet, proso millet and pearl millet are comparatively higher than the protein content in wheat. Pearl millet ha high fat content (5.00 g /100g). The carbohydrate content in small millet is less than that of rice and wheat. The carbohydrate content per 100 grams of the grain ranges from 307.00 grams to 361.00 grams. Kodo, little, foxtail and barnyard millets are high in fiber. Finger millet has a remarkable amount of calcium 344.00mg / 100g. Millets are also rich sources of iron. The iron content of little and pearl millet is 9.30 and 8.00mg /100g respectively. (Gopalan *et al.*, 2013) [4] stated that the protein, iron an energy content of barnyard and pearl millet is much higher and hence these two millets were used in higher proportions.

Table 1: Overview of nutritional composition of millets (per 100g)

Sl. No.	Millets	Protein (g)	Fat (g)	CHO (g)	Energy (K.cal)	Crude Fibre (g)	Calcium (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)
1.	Rice	6.40	0.40	79.00	346.00	0.20	9.00	1.00	0.21	0.05
2.	Wheat	11.80	1.50	71.20	346.00	1.20	41.00	5.30	0.45	0.17
3.	Finger millet	7.30	1.30	72.00	328.00	3.60	344.00	3.90	0.42	0.19
4.	Little millet	7.70	4.70	67.00	341.00	7.60	17.00	9.30	0.30	0.09
5.	Kodo millet	8.30	1.40	65.90	309.00	9.00	27.00	0.50	0.33	0.09
6.	Foxtail millet	12.30	4.30	60.90	331.00	8.00	31.00	2.80	0.59	0.11
7.	Proso millet	12.50	1.10	70.40	341.00	2.20	14.00	0.80	0.20	0.18
8.	Barnyard millet	6.20	2.20	65.50	307.00	9.80	20.00	5.00	0.33	0.10
9.	Sorghum	10.40	1.90	72.60	349.00	1.60	25.00	4.10	0.37	0.13
10.	Pearl millet	11.60	5.00	67.50	361.00	1.20	42.00	8.00	0.33	0.25

***Source*:** Post Harvest Technology Centre, Tamil Nadu Agricultural University Coimbatore

Demographic profile of respondents

The study found that the majority of respondents comes under the age group 31-40 followed by 20-30 years and the average income ranges from Rs. >40,000 (Tables 2 and 3).

Table 2: Age group of the respondents

Particulars	20-30 years	31-40 years	41-50 years	Above 50 years	Total
Frequency	51	66	24	9	150
Percentage	34%	44%	16%	6%	100%

Table 3: Income of the respondents

Particulars	Rs < 10000	Rs. 11,000 to 25,000	Rs. 26,000 to 40,000	Rs. >40,000	Total
Frequency	9	24	42	75	150
Percentage	6%	16%	28%	50%	100%

Millet based recipe contest

The results of the study confirmed that almost a hundred percent respondents are aware of the existence of millets (Table 4) and Family is the predominant source of information of recipes of millets (Table 5), Among all respondents, only (47%) of the respondents are consuming millet (Table 6) of which (30%) consume it occasionally, 20% regularly and 50% of them consume it weekly (Table 7).

Table 4: Awareness regarding millets

Particulars	Frequency	Percentage
Yes	150	100%
No	0	0
Total	150	100%

Table 5: Source of Recipes of millets

Particulars	Frequency	Percentage
Family	75	50%
Relatives	42	28%
You tube	24	16%
Google	09	6%
Total	150	100%

Table 6: Consumption of Millets

Particulars	Frequency	Percentage
Yes	70	47%
No	80	53%
Total	150	100%

Table 7: Frequency of Consumption

Particulars	Frequency	Percentage
Regularly	14	20%
Weekly	35	50%
Occasionally	21	30%
Total	70	100%

The sources of learning about cultivation of millets and preparation method of millet based food were also analyzed (Fig. 1 & Fig. 2). Over 42.0% of the contribution of knowledge about cultivation methods from the father, followed by the mothers (31.0%) and grandfathers (12.0%) respectively. 56% learned the method of preparing millet-based food from their mother, followed by 20% from mother-in-law. The learning about the cultivation and its use from other sources was also significant. In this learning process, the husband, Gaon Burha, grandmother, relatives and neighbour played an interesting role in creating and transferring knowledge networks within families. Results indicated that older people of the family still forms an indispensable role in transmitting indigenous knowledge to the younger generations, as reported also by (Sherry & Shukla, 2003) [5]. On the fixed day contest started, the Jury tasted the food products prepared by the participants. As per the rules of the contest, A total of 15 winners (Five from each village) were selected as first, second, third, fourth and fifth prize winners. The prizes included wall clock, bottles and bowl set. and all the prize winners received a certificate.

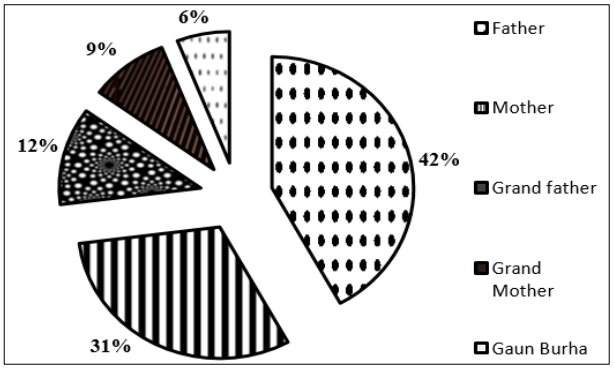

Fig 1: Percentage contribution of sources of learning of cultivation method

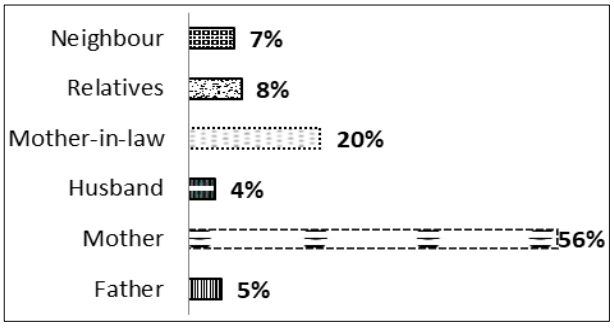

Fig 2: Percentage contribution of sources of learning of preparation method of millet based food

Recipes prepared by Participants

They uses millets in many forms. Millet chapattis are the most common food after Wheat and Rice. Millet rice, pulav and khichadi are also very popular. Porridge from millets made occasionally during Festival, Marriage, and other occasions. Millets flour used to prepare Bhajia, Saloni, Chila, Puri, Paratha, Dhokla, soup, appe, Chausera etc. and many types of sweets like halwa, burfi and Laddoo (Table 8). Based on the sensory evaluation of recipes, it revealed that the jury had a positive impression about all the formulated recipes. The mean overall acceptability score ranged from 4.2 to 4.8, depending on the recipe (Table 9). 80–100% millets were included in the formulation of the recipes. In addition to millets, the recipes included one or more legumes, and also contained some vegetables. In the present scenario, many health related problems are increasing, along with this awareness among people is also increasing. Now people are started thinking about their health. Considering the health benefits of millets, people are taking interest towards uses of traditional foods in their daily life.

Table 8: List of Prepared Food Products of Millets

S.N.	Particulars	No. of items prepared
1.	Sanwa Kheer	10
2.	Sanwa Pulav	05
3.	Kodo Kheer	10
4.	Kodo Puri	12
5.	Kodo Burfi	05
6.	Kodo Laddoo	05
7.	Kodo Poha	04
8.	Kodo Soup	04
9.	Kodo Pulav	08
10.	Kodo Khichadi	12
11.	Kodo Bhajia	10
12.	Barley fara	05
13.	Barley kheer	06
14.	Barley paratha	04
15.	Barley Chappati	15
16.	Kutki chila	05
17.	Kutki Kheer	07
18.	Bajre ka Chausera	08
19.	Bajra Puri	05
20.	Bajra Chappati	15
21.	Bajra Halwa	05
22.	Bajra Appe	04
23.	Puffed Bajra	10
24.	Jowar Kachori	08
25.	Puffed Jowar	10
26.	Jowar Dhokla with urd chutney	06
27.	Maize ka Chausera	10
28.	Maize Halwa	10
29.	Maize Burfi	08
30.	Maize Dhokla	06
31.	Maize puri	15
32.	Maize Chappati	20
33.	Maize Bhajiya	20
34.	Maize Saloni	07
35.	Puffed Maize	20
	Total	314

Table 9: Prepared Food Products of Millets and Sensory Attributes

S. N.	Particulars	Taste mean	Appearance mean	Smell mean	Overall Acceptability Mean
1.	Sanwa Kheer	4.8	4.4	4.5	4.6
2.	Sanwa Pulav	4.6	4.4	4.5	4.5
3.	Kodo Kheer	4.8	4.3	4.5	4.6
4.	Kodo Puri	4.4	4.5	4.5	4.5
5.	Kodo Burfi	4.4	4.3	4.4	4.5
6.	Kodo Laddoo	4.7	4.5	4.6	4.7
7.	Kodo Poha	4.7	4.6	4.6	4.7
8.	Kodo Soup	4.5	4.4	4.5	4.6
9.	Kodo Pulav	4.6	4.5	4.5	4.5
10.	Kodo Khichadi	4.6	4.5	4.6	4.7
11.	Kodo Bhajia	4.4	4.5	4.5	4.6
12.	Barley fara	4.4	4.4	4.4	4.4
13.	Barley kheer	4.5	4.4	4.4	4.4
14.	Barley paratha	4.4	4.4	4.4	4.4
15.	Barley Chappati	4.2	4.4	4.2	4.3
16.	Kutki chila	4.6	4.5	4.5	4.5
17.	Kutki Kheer	4.7	4.5	4.5	4.6
18.	Bajre ka Chausera	4.2	4.4	4.4	4.3
19.	Bajra Puri	4.3	4.4	4.4	4.4
20.	Bajra Chappati	4.4	4.5	4.5	4.5
21.	Bajra Halwa	4.6	4.6	4.6	4.6
22.	Bajra Appe	4.8	4.8	4.8	4.8
23.	Puffed Bajra	4.2	4.2	4.2	4.2
24.	Jowar Kachori	4.8	4.8	4.8	4.8
25.	Puffed Jowar	4.4	4.5	4.4	4.4
26.	Jowar Dhokla with urd chutney	4.8	4.8	4.7	4.8
27.	Maize ka Chausera	4.3	4.3	4.3	4.3
28.	Maize Halwa	4.5	4.4	4.4	4.4
29.	Maize Burfi	4.4	4.3	4.3	4.3
30.	Maize Dhokla	4.6	4.5	4.5	4.5
31.	Maize puri	4.4	4.4	4.4	4.4
32.	Maize Chappati	4.5	4.4	4.4	4.4
33.	Maize Bhajiya	4.4	4.5	4.4	4.4
34.	Maize Saloni	4.3	4.4	4.4	4.4
35.	Puffed Maize	4.2	4.4	4.4	4.3

To know the impact of the contest, feedback taken from both the participants and the local people. The role of this contest was more significant in creating awareness about the importance of millets (68%). This process of competition developed a positive attitude among the rural community towards its cultivation, conservation and sustainable utilization (39%). The knowledge of rural women regarding traditional knowledge of millets not only contributes to improving livelihoods, health and nutrition, but also strengthen the capacity for sustainable management of natural resources (Singh & Singh, 2013) [6].

Conclusion

Millets are a staple food that are easily grown in dry land area. Due to the drudgery involved in processing, preparation and consumption, the trend of this highly nutritious food is on the decline. Most of the people are still ignorant about its nutritional value and most of the people are also unaware of the cooking techniques and consumption patterns. Therefore steps should be taken to analyze the nutrient content of such indigenous foods and make modifications to each traditional food nutritionally balanced and adequate.

Conflict of Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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