A study on the consumption pattern and chemical composition of composite flour in Rajasthan

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ABSTRACT

Malnutrition, including micronutrient deficiencies, remains a significant global health issue, particularly in developing countries. Traditional diets, rich in diverse nutrients, offer potential solutions. This study explored the dietary practices in Rajasthan, focusing on the consumption of Missi Roti, a traditional mixed-flour flatbread. A survey revealed that Missi Roti was being widely consumed due to its taste and perceived health benefits. The study analyzed the nutritional composition of various flour blends used in Missi Roti preparation, including wheat, gram, barley, maize and foxtail millet. Results indicated that millet-based flours were richer in micronutrients compared to wheat flour. Sensory evaluation revealed that, while wheat-based chapattis were preferred for taste and texture, millet-based chapattis were visually appealing. The findings suggested that incorporating diverse grains into daily diets, particularly through traditional food practices like Missi Roti, could contribute to improved nutritional intake and reduced risk of malnutrition. Further research is needed to explore the long-term health benefits of such dietary practices.

Keywords: Malnutrition; traditional food; Missi Roti; composite flour; nutritional composition

INTRODUCTION

The presence of multiple micronutrient deficiencies in the absence of an energy-deficit diet is often described as hidden hunger (Black et al 2013). Micronutrient deficiency is common and associated with malnutrition. Approximately 2-3 billion people worldwide are estimated to suffer from micronutrient deficiencies, especially in developing countries (Olanbiwoninu et al 2023). A persistently high prevalence of underweight is coexisting with an increased prevalence of overweight/obesity in India (Dutta et al 2019). Malnutrition is the most severe consequence of food insecurity amongst children under the age of 5 years (Wali et al 2019).

Traditional foods, often rich in nutrients, can contribute to overall health and well-being (Ghosh et al 2023). These diets, associated with reduced risks of chronic diseases, can promote healthier eating patterns and prevent diet-related health problems. Combining grain and legume proteins can improve the overall amino acid profile, addressing global protein-calorie malnutrition (Livingstone et al 1993). Composite flours, made from wheat and legumes, offer a cost-effective way to produce high-quality food products (Kadam et al 2012).

Composite flours or mixed flours are gaining popularity due to their potential health benefits. By partially or fully replacing wheat flour, these blends can help mitigate lifestyle diseases. The increasing health consciousness and busy lifestyles of consumers have driven the demand for healthier food options, making composite flours a significant trend in the food and nutrition industry.

In Rajasthani traditional cuisine, various types of chapattis are consumed like Missi Roti, Tikad, Rumali Roti, Bejad Roti, Prantha, Pania, Sogra, Kulcha, Bhatoore, Tandoori Roti, Naan etc. Versatile Rajasthani culture has different types of chapatties only; among all these variations Missi Roti has its unique place. It is due to its special taste and flour combinations.

The present study was conducted to study mixed flour Roti preparation pattern in Rajsthani cuisine and the chemical composition of different mixed flours.

MATERIAL and METHODS

Under present research, household survey was conducted on 100 respondents at Ratangarh, Churu and Udaipur of Rajasthan to know the consumption pattern of Missi Roti. Missi Roti preparation was developed and standardized under laboratory conditions. Commonly consumed food grains were selected to prepare the flours for Missi Roti in the ratio of 3:2 and 3:1:1. Basic and developed flours were selected on the basis of commonly consumed flour consumption pattern to produce dietary diversity in regular regime. Chemical composition of the flours was analyzed as per Anon (2023). Chapattis were evaluated for their sensory parameters using standard method through selected and trained panel of judges (Griswold 1962).

RESULTS and DISCUSSION

Data in Table 1 reveal that Missi Roti was being consumed by 67 per cent of the subjects once or twice a day as it was good in taste and helpful to manage diseases especially non-communicable. Among them 38, 24 and 5 per cent subjects had been consuming composite flour for less than 5, 5-10 and more than 10 years respectively. Majority of them (75%) were consuming mixed Roti on the advice of doctors followed by friends (71%) and mass media (41%). Most of them (90%) consumed mixed flour as they opined that it reduced blood glucose; 50 per cent for the reason that it was beneficial for health and 18 per cent due to family tradition. Majority (37%) of the subjects were consuming combination of wheat with Bengal gram and barley and 20 per cent of wheat with Bengal gram in different proportions. Most of them mixed different flours before grinding (86%) followed by those who mixed after grinding (12%) and only 1 per cent purchased readymade composite flour.

Blends of the flours were developed by mixing of wheat with Bengal gram and/or barley in such a proportion that chapatti making quality could be maintained.

Chemical composition of developed preparations was analyzed. Data given in Table 2 depict that the carbohydrate content ranged from 63 (wheat + Bengal gram flour and foxtail + Bengal gram flour) to 78 (maize flour) mg per kg. The fat content was maximum (4 mg/kg) in foxtail flour and minimum (0.9 mg/kg) in maize flour. Protein content ranged from 6 (bajra flour) to 21 (wheat + Bengal gram flour) mg per kg. Bajra flour exhibited highest energy (363 Kcal) and lowest (336 Kcal) was recorded in foxtail + Bengal gram + barley flour.

Maximum magnesium content was recorded in maize + Bengal gram (151 mg/kg) followed by wheat + Bengal gram and bajra + Bengal gram (150 mg/kg each) and minimum in foxtail (81 mg/kg) flours. Potassium content was highest in bajra (307 mg/kg) and lowest in foxtail + Bengal gram and foxtail + Bengal gram + barley (150 mg/kg each) flours. Foxtail flour contained maximum sulphur (171 mg/kg) which was minimum in maize + Bengal gram flour (68 mg/kg). Wheat flour contained maximum sodium (17 mg/kg) and minimum was recorded in foxtail + Bengal gram and foxtail + Bengal gram + barley (3 mg/kg each) flours. Chloride content was also highest (47 mg/kg) in wheat flour and minimum in foxtail + Bengal gram (22 mg/kg) flours. Foxtail and foxtail + Bengal gram flours contained 0.03 mg per kg chromium, whereas, it was absent in maize flour.

Calcium was highest (38 mg/kg) in wheat + Bengal gram + barley and foxtail + Bengal gram and lowest in maize (19 mg/kg) flours. Foxtail and foxtail + Bengal gram + barley flours contained maximum phosphorus (320 mg/kg each) and bajra flour contained the minimum (220 mg/kg). Foxtail flour exhibited maximum zinc (15.0 mg/kg) and wheat + Bengal gram + barley the minimum (5.0 mg/kg). Maize, maize + Bengal gram, foxtail + Bengal gram and bajra + Bengal gram + barley flours contained 0.6, 0.5, 0.4 and 0.3 mg per kg cobalt respectively, whereas, it was absent in other flours. Wheat + Bengal gram flour had highest (1.2 mg/kg) and maize the lowest (0.5 mg/kg) copper content. Iron was maximum (10.4 mg/kg) in wheat + Bengal gram + barley flour and minimum (4.6 mg/kg) in bajra flour. Foxtail flour contained maximum (5.0 mg/kg) manganese which was minimum in (0.5 mg/kg) in maize flour.

Among vitamins, maximum NCN, riboflavin and thiamin contents of 5.5, 0.25 and 0.59 per cent were recorded in wheat, bajra and foxtail flours and

Table 1. Consumption, composition and preparation of composite flour by the respondents

Component	Frequency (%)
Duration of consumption	
Less than 5 years	38
5-10 years	24
More than 10 years	5
Not consuming composite flour	33
Advised by*	
Doctor	75
Friends	71
Mass media	41
Others	8
Reason for consuming composite flour*	
Controls blood glucose	90
Beneficial for health	50
Family tradition	18
Composition of composite flour	
Wheat + Bengal gram + barley	37
Wheat + Bengal gram 1:1	4
Wheat + Bengal gram 3:7	10
Wheat + Bengal gram 3:2	6
Wheat + Bengal gram + barley + soybean	1
Others	42
Mode of preparation of composite flour	
Mixed before grinding	86
Mixed after grinding	12
Readymade composite flour	1

*Multiple responses

minimum of 1.8, 0.1 and 0.32 per cent in maize, maize and bajra + Bengal gram flours (Fig 1).

The organoleptic test was conducted on the chapattis made from different composite flours. Table 3 depicts that in appearance, bajra chapatti was most preferred with 8.5 points followed by bajra + Bengal gram (8.4 points) and bajra + Bengal gram + barley (8.4 points). However, the chapatti made of wheat flour was best in taste (8.1 points) followed by bajra, Bajra + Bengal gram and bajra + Bengal gram + barley (7.7 points each). In flavour, wheat + Bengal gram chapatti was best (7.6 points) followed by wheat and maize chapattis (7.5 points each). Wheat and maize chapattis had best texture (7.5 points each) followed by bajra + Bengal gram + barley (7.4 points). Maize chapatti had the highest acceptability (7.8 points) followed by bajra + Bengal gram (7.7 points).

Composite flour was nutritionally superior to wheat flour, with higher levels of ash, insoluble fiber, energy, calcium, and phenols. Storage stability tests showed acceptable levels of oxidative and microbial spoilage. Sensory evaluation indicated moderate consumer acceptance of composite flour chapattis (Tangariya et al 2018).

Sankararao et al (2016) developed fortified bread using a blend of soybean, flaxseed and ragi flours. Replacing 15, 20 and 25 per cent of whole wheat flour with this blend increased the bread's fiber, ash, fat and protein content. The 15 per cent fortified bread exhibited similar physical, textural and sensory properties to the control bread.

CONCLUSION

This study highlights the significance of traditional food practices in addressing malnutrition and promoting dietary diversity. Missi Roti, a popular Rajasthani flatbread made from a blend of flours, offers a nutritious and culturally relevant food option. The study also observed that the nutritional composition of Missi Roti can vary significantly based on the types of the flours used. Millet-based flours, such as bajra and foxtail millet, were found to be particularly rich in micronutrients. However, wheat-based flours were generally preferred for their taste and texture. To promote healthier dietary practices,

Table 2. Chemical composition of composite flours prepared

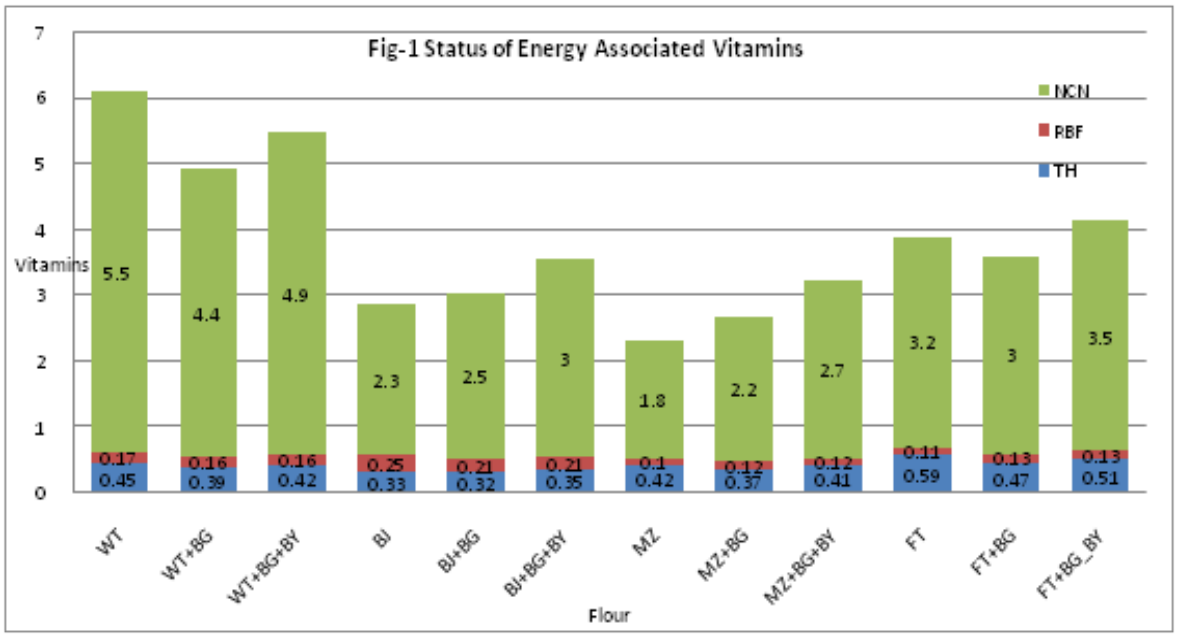
Flour	Carbohydrate (mg/kg)	Fat (mg/kg)	Protein (mg/kg)	Energy (Kcal)
Wheat	74	1	13	362
Wheat + Bengal gram	63	2	21	359
Wheat + Bengal gram + barley	67	2	18	361
Bajra	77	3	6	363
Bajra + Bengal gram	66	3	16	354
Bajra + Bengal gram + barley	71	3	13	357
Maize	78	0.9	10	361
Maize + Bengal gram	70	1	16	354
Maize + Bengal gram + barley	73	1	13	353
Foxtail	67	4	13	352
Foxtail + Bengal gram	63	2	18	345
Foxtail + Bengal gram + barley	69	1	13	336

Table 2. Contd…..

Flour	Mg (mg/kg)	K (mg/kg)	S (mg/kg)	Na (mg/kg)	Cl (mg/kg)	Cr (mg/kg)
Wheat	138	284	128	17	47	0.01
Wheat + Bengal gram	150	170	77	10	28	0.01
Wheat + Bengal gram + barley	120	170	103	10	46	0.01
Bajra	137	307	147	10	39	0.02
Bajra + Bengal gram	150	184	88	7	23	0.02
Bajra + Bengal gram + barley	120	184	114	7	46	0.02
Maize	139	286	114	16	33	0.00
Maize + Bengal gram	151	171	68	10	20	0.01
Maize + Bengal gram + barley	121	172	94	10	38	0.01
Foxtail	81	250	171	5	37	0.03
Foxtail + Bengal gram	116	150	102	3	22	0.03
Foxtail + Bengal gram + barley	87	150	129	3	40	0.02

Table 2. Contd…..

Flour	Ca (mg/kg)	P (mg/kg)	Zn (mg/kg)	Co (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Mn (mg/kg)
Wheat	36	302	7.3	0.0	0.9	9.6	1.0
Wheat + Bengal gram	37	259	9.0	0.0	1.2	9.9	1.0
Wheat + Bengal gram + barley	38	294	5.0	0.0	0.9	10.4	0.7
Bajra	21	220	6.2	0.0	0.39	4.6	1.0
Bajra + Bengal gram	30	248	6.0	0.0	0.8	4.9	1.0
Bajra + Bengal gram + barley	31	250	9.0	0.3	0.8	4.8	0.7
Maize	19	290	11.0	0.6	0.5	6.5	0.5
Maize + Bengal gram	26	300	6.0	0.5	1.0	6.9	0.9
Maize + Bengal gram + barley	29	300	10.0	0.0	0.6	8.6	1.0
Foxtail	28	320	15.0	0.0	1.0	8.9	5.0
Foxtail + Bengal gram	38	310	13.0	0.4	1.0	7.9	3.0
Foxtail + Bengal gram + barley	28	320	11.0	0.0	1.0	9.3	2.0



WT = Wheat, BG = Bengal gram, BY = Barley, BJ = Bajra, MZ = Maize, FT = Foxtail, NCN = North coast naturals, RBF = Riboflavin, TH = Thiamine

Fig 1. Vitamin content of composite flours prepared

Table 3. Results of organoleptic test of chapattis made of composite flours

Flour	Appearance	Taste	Flavour	Texture	Overall acceptability
Wheat	7.3	8.1	7.5	7.5	7.4
Wheat + Bengal gram	7.2	7.3	7.6	7.1	7.5
Wheat + Bengal gram + barley	7.3	7.1	7.4	7.1	7.3
Maize	8.1	7.6	7.5	7.5	7.8
Maize + Bengal gram	7.8	7.5	7.1	7.3	7.5
Maize + Bengal gram + barley	8.0	7.4	7.3	7.3	7.5
Foxtail	7.6	7.2	6.7	7.3	7.3
Foxtail + Bengal gram	7.5	7.2	6.6	7.2	7.2
Foxtail + Bengal gram + barley	7.6	7.1	6.7	7.3	7.1
Bajra	8.5	7.7	7.1	7.2	7.6
Bajra + Bengal gram	8.4	7.7	7.2	7.2	7.7
Bajra + Bengal gram + barley	8.4	7.7	7.1	7.4	7.3

it is essential to encourage the consumption of diverse grains and legumes. By incorporating traditional foods into modern diets, nutritional outcomes can be improved and malnutrition can be reduced. Research is needed to explore the long-term health benefits of such dietary interventions.

REFERENCES

Anonymous 2023. Official methods of analysis of AOAC international. 22nd Edn, Association of Official Analytical Chemists International, Rockville, Maryland.

Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, Ezzati M, Grantham-McGregor S, Katz J, Martorell R and Uauy R 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet **382(9890):** 427-451.

Dutta M, Selvamani Y, Singh P and Prashad L 2019. The double burden of malnutrition among adults in India: evidence from the National Family Health Survey-4 (2015-16). Epidemiology and Health **41:** e2019050; doi: 10.4178/epih.e2019050.

Ghosh S, Meyer-Rochow VB, Jung C 2023. Embracing tradition: the vital role of traditional foods in achieving

nutrition security. Foods **12(23):** 4220; doi: 10.3390/ foods12234220.

Griswold RM 1962. The experimental study of foods. Houghton Mifflin Company. Boston, New York, 577p.

Kadam ML, Salve RV, Mehrajfatema ZM and More SG 2012. Development and evaluation of composite flour for Missi Roti/chapatti. Journal of Food Processing and Technology **3(1):** 1000134; doi: 10.4172/2157-7110.1000134.

Livingstone AS, Feng JJ and Malleshi NG 1993. Development and nutritional quality evaluation of weaning foods based on malted, popped and dried wheat and chickpea. International Journal of Food Science and Technology **28(1):** 35-43.

Olanbiwoninu A, Greppi A, Awotundun T, Adebayo EA, Spano G, Mora D and Russo P 2023. Microbial-based bio-fortification to mitigate African micronutrients deficiency: a focus on plant-based fermentation as source of B-group vitamins. Food Bioscience **55:** 102996doi: 10.1016/j.fbio.2023.102996.

Sankararao D, Anjineyulu K, Ranasalva N , Bodhankar HB and Chavan PD 2016. Development of composite flour bread and its effect on physical, sensory and nutritional characteristics. International Journal of Agriculture Sciences **8(57):** 3110-3114.

Tangariya P, Sahoo A, Awasthi P and Anupama Pandey A 2018. Quality analysis of composite flour and its effectiveness for chapatti formulation. Journal of Pharmacognosy and Phytochemistry **7(4):** 1013-1019.

Wali N, Agho K and Renzaho AMN 2019. Past drivers of and priorities for child under-nutrition in south Asia: a mixed methods systematic review protocol. Systematic Reviews **8(1):** 189; 10.1186/s13643-019-1112-7.