

## Cultivar differences and the effect of processing on the nutrient composition of rice

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Recommended

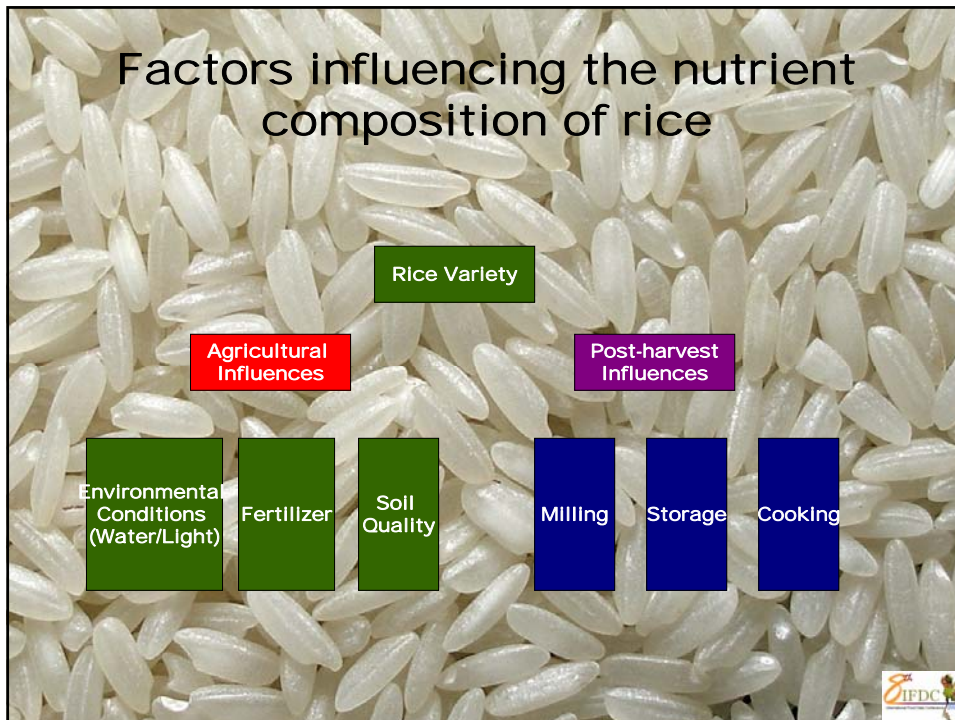
III.9.8 The evaluation of the composition and consumption of cultivars should continue for development of food biodiversity indicators to guide agro-biodiversity conservation and human nutrition. Increasing the availability and promoting the use of whole grain and moderately milled rice and rice products will provide human nutrition benefits, particularly related to micronutrients



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## Proximate composition of 258 rice cultivars and the effect of polishing

	0%		5%		10%	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Moisture g%	8.51±1.6	4.0-12.7	8.53±1.47	4.17-12.7	8.54±1.45	3.94-12.7
Protein g%	9.08±1.5	6.4 -13.09	8.92 ±1.39	6.14 -12.9	8.76 ±1.38	5.85 -12.7
Fat g%	2.39±0.53	1.9-4.3	1.48±0.45	0.63 -3.99	1.0±0.41	0.3-2.78
Ash g%	1.45±0.20	1.05 -1.2.1	1.0±0.20	0.61 - 1.75	0.71±0.3	0.42 - 1.23
Crude fiber g%	0.43±0.27	0.15 -1.47	0.15±0.08	0.04 - 0.44	0.1 ±0.06	0.02 - 0.33
Carbohydrate g%	77.4±3.75	79.4 - 88.	79.3±3.63	74.1- 89.9	80.0±3.55	74.4 -90.5

## Proximate composition and mineral content of Brown Rice according to grain types

Grain type	LB	LS	MS	SB	SS
N	44	41	43	49	15
Protein g%	10.91±1.27	9.9±1.08	10.15±1.38	10.2±1.5	10.25±0.89
Fat g%	2.43±0.50	2.21±0.57	2.45±0.61	2.44±0.51	2.51±0.41
Ash g%	1.38±0.14	1.40±0.15	1.37±0.16	1.41±0.15	1.45±0.21
Crude fiber g%	0.33±0.24	0.46±0.33	0.45±0.42	0.42±0.30	0.76±0.41
Carbohydrate g%	76.4±2.67	78.0±4.35	77.3±4.54	78.5±4.8	75.2±1.43

### Frequency distribution (%) of proximate composition

Protein Nx5.94 (g%)	<9.0	9 - 12	>12.0
Brown rice	45.2	51.0	3.3
5% Polished rice	52.1	45.5	2.5
10% Polished rice	57.4	40.1	1.7
Fat (g%)	<2.0	2 -3	>3
Brown rice	16.3	73.2	10.5
5% Polished rice	88.0	11.2	0.8
10% Polished rice	96.9	3.1	-----
Ash (g%)	<1.0	1.0 - 1.5	>1.5
Brown rice	-----	63.7	36.3
5% Polished rice	56.8	40.5	2.7
10% Polished rice	85.3	14.3	0.4



### Fatty acid composition of 30 rice cultivars with > 3g% fat

Fatty Acid	Mean ± SD	Range
Myristic acid 14:0	0.24 ± 0.08	0.12 - 0.48
Palmitic acid 16:0	20.02 ± 1.02	17.82-22.56
Palmitoleic acid 16:1	0.24 ± 0.08	0.18-0.31
Stearic acid 18:0	2.02 ± 0.41	1.32-2.56
Oleic acid 18:1	44.81 ± 2.02	40.21-50.18
Linoleic acid 18:2	31.58 ± 1.87	28.02-33.44
Linolenic acid 18:3	1.44 ± 0.67	1.08-2.32
Arachidic acid 20:0	0.66 ± 0.21	0.42-0.98
Gadoleic acid 20:1	0.54 ± 0.06	0.38-0.66
Behenic acid 22:0	0.42 ± 0.04	0.36-0.52
Lignoceric acid 24:0	0.74 ± 0.08	0.54-0.92



## Effect of nitrogen conversion factors on the Protein content in rice

	0%		5%		10%	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Protein (N x 6.25)	10.08±1.38	7.11-14.19	9.82±1.35	7.11- 3.82	9.62±1.35	6.77 -13.7
Protein (N x 5.94)	9.08 ± 1.57	6.4 -13.09	8.92 ±1.39	6.14 -12.9	8.76 ±1.38	5.85 -12.7
Protein (N x 5.4)	8.34 ± 1.45	6.0 - 11.6	8.22 ±1.16	6.1 -11.7	8.07 ±1.15	5.32 -11.6

## Amino acid composition of 30 rice cultivars

Amino Acid	0%	5%	10%
Aspartic Acid	8.32 ± 0.59	8.23 ± 0.43	8.25 ± 0.49
Threonine	3.26 ± 0.31	3.21 ± 0.22	3.22 ± 0.42
Serine	4.53 ± 0.49	4.42 ± 0.33	4.45 ± 0.34
Glutamic acid	17.92 ± 1.4	18.06 ± 1.09	18.08 ± 1.09
Proline	5.1 ± 0.84	5.14 ± 0.82	4.90 ± 0.62
Glycine	4.20 ± 0.3	4.11 ± 0.26	4.09 ± 0.26
Alanine	5.37 ± 1.11	5.46 ± 0.36	5.42 ± 0.36
Cysteine	1.31 ± 0.48	1.34 ± 0.34	1.29 ± 0.40
Valine	4.54 ± 0.98	4.77 ± 0.42	4.82 ± 0.38
Methionine	2.0 ± 0.50	2.05 ± 0.25	2.14 ± 0.25
Isoleucine	3.67 ± 0.76	3.80 ± 0.35	3.84 ± 0.30
Leucine	7.25 ± 0.55	7.23 ± 0.51	7.25 ± 0.44
Tyrosine	4.80 ± 0.40	4.96 ± 0.43	5.03 ± 0.46
Phenylalanine	4.87 ± 0.41	5.01 ± 0.43	5.08 ± 0.45
Histidine	2.21 ± 0.20	2.20 ± 0.2	2.22 ± 0.21
Lysine	3.46 ± 0.29	3.39 ± 0.29	3.41 ± 0.28
Arginine	7.5 ± 1.51	7.72 ± 0.45	7.76 ± 0.45

### Descriptive statistics for essential amino acid content in 30 rice cultivars

	Protein	Thr	Val	Met	Iso	Leu	Phe	His
Mean	9.08	3.26	4.54	1.98	3.67	7.24	4.88	2.21
SD	1.57	0.06	0.98	0.52	0.14	0.55	0.41	0.20
Minimum	6.38	2.75	3.37	1.23	3.18	6.26	4.29	1.79
Maximum	13.09	4.10	5.6	3.0	4.3	8.30	5.83	2.58
Correlat								
Thr	-0.273**							
Val	-0.330**	0.128						
Met	-0.544**	0.363**	0.653**					
Ile	-.0380**	0.182	0.865**	0.647**				
Leu	-0.051	0.716**	0.181	0.144	0.322**			
Phe	-0.027	0.714**	0.232*	0.045	0.313**	0.708**		
His	-0.311	0.803**	0.269*	0.160	0.356**	0.655**	0.893**	
Lys	-0.474**	0.703**	0.262*	0.347**	0.347**	0.515**	0.516**	0.716**

\*Correlation is significant at 5% probability level (Two tailed)  
\*\*Correlation is significant at 1% probability level (Two tailed)



### Mineral content of rice cultivars and the effect of polishing

	0%		5%		10%	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Fe mg%	1.15±0.50	0.52- 3.75	0.70±0.31	0.21- 3.06	0.55±0.29	0.11 - 2.9
Zn mg%	2.45±0.46	1.01-4.15	1.96±0.41	0.72-3.34	1.76±0.40	0.36-3.33
Mn mg%	1.57±0.71	0.58 - 4.9	1.06±0.43	0.45 -3.02	0.91±0.33	0.42-2.34
Cu mg%	0.32±0.17	0.47 - 1.9	0.25±0.09	0.09- 0.64	0.23±0.08	0.08 - 0.55
Mg mg%	122±20	69 - 188	83 ±21	29 - 145	64 ±23	23 - 121
P mg%	281±74	113 - 498	196±51	103 - 407	154±39	79 - 288
Ca mg%	11.9 ±4.49	2.8 - 25.5	8.96 ±3.31	2.03-24.4	7.80±3.07	1.4-17.09



### Mineral and vitamin content of rice according to grain types (Brown rice)

Grain type	LB	LS	MS	SB	SS
Iron mg%	1.36±0.72	1.05±0.26	1.07±0.37	1.28±0.61	1.08±0.17
Zinc mg%	2.46±0.48	2.49±0.53	2.43±0.47	2.61±0.41	2.54±0.56
Calcium mg%	11.29±3.14	10.23±3.64	11.01±4.50	8.82±3.10	12.66±3.7
Thiamin mg%	0.71±0.48	0.72±0.47	0.66±0.45	0.57±0.40	1.0±0.36
Niacin mg%	3.82±1.13	3.34±1.06	3.73±1.28	4.07±1.34	3.17±0.96



### Correlations among seven mineral content in milled rice

Element	Fe	Zn	Cu	Mn	Ca	Mn	P
Zinc	0.459**						
Coper	0.484**	0.280**					
Manganese	0.383**	0.381**	0.111**				
Calcium	0.299**	0.101**	0.118**	0.109**			
Magnesium	0.512**	0.611**	0.260**	0.460**	0.331**		
Phsphorus	0.565**	0.430**	0.279**	0.495**	0.370**	0.610**	
Phytate	0.402**	0.479**	0.188**	0.517**	0.446**	0.774**	0.607**

\*\* Correlation is significant at 0.01 level (2 tailed)



### Frequency distribution(%) of Fe, Zn & Ca

Iron mg%	<1.0	1 - 2	>2.0
Brown rice	46.4	47.7	5.9
5% Polished rice	89.8	9.7	0.4
10% Polished rice	96.9	2.7	0.4
Zinc mg%	<2.0	2 - 3	>3.0
Brown rice	13.1	73.4	13.5
5% Polished rice	62.4	37.2	0.4
10% Polished rice	77.0	22.6	0.4
Calcium mg%	<10	10 - 15	>15.0
Brown rice	34.7	41.9	23.4
5% Polished rice	61.1	36.3	2.7
10% Polished rice	74.3	24.8	0.9



### Phytate content of rice cultivars and the effect of polishing

	0%		5%		10%	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Phytate mg/g	5.42±1.3	3.77- 9.33	3.4±0.71	2.15- 5.7	2.33±0.49	1.45-3.6



## B- vitamin content of rice cultivars and the effect of polishing

	0%		5%		10%	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Thiamine mg%	0.59±0.38	0.17- 1.91	0.33±0.18	0.1 -1.03	0.24±0.11	0.06–0.63
Riboflavin mg%	0.043 ± 0.007	0.027 - 0.061	0.36 ± 0.006	0.019 - 0.041	0.025 ± 0.006	0.014 - 0.051
Niacin mg%	3.69±1.13	1.89-8.58	2.36±0.78	1.02-4.93	1.86±0.72	0.71-4.3

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## Conclusion

- Milling significantly reduced all the macronutrients, minerals and vitamin content in rice
- The results showed that macro and micro nutrient content of rice was clearly different among cultivars providing opportunity to selectively breed cultivars for higher nutrient content.
- Significant correlation was observed among the macro and micro nutrients studied which may assist future selection of appropriate rice genotypes for specific nutritional needs.