How do ricebean and other pulses meet nutrient deficiencies among women of reproductive age in rural populations in Hill areas in India and Nepal?

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Points to be adressed

- Nutritional value of ricebean compared to standard recommendations
- Nutritional value of ricebean compared to other pulses
- Local diets and forecasted deficiencies
- The role of pulses in the diets
- The potential of ricebean to reduce nutritional deficits

	Content of 100 g ricebean	% of RDI/AI/DRA at 60 g/day
Total protein	**18 g**	**28.4**
Threonine	**0.536 g**	**32.8**
Isoleucine	**0.942 g**	**60.7**
Leucine	**1.304 g**	**38.0**
Lysine	**1.074 g**	**34.6**
Methionine + cysteine	**0.421 g**	**27.1**
Histidine	**0.648 g**	**56.7**
Tryptophane	**0.171g**	**53.7**
Phenylanaline + tyrosine	**1.349 g**	**50.0**
Valine	**1.022g**	**312.0**

	Content in 100 g ricebean	% of RDI /DRA/AI of 60 g/day
Vitamin A	**<21µg**	**-**
Vitamin B1	**0.49 mg**	**32.6**
Vitamin B2	**0.31 mg**	**34.4**
Vitamin B3	**2.88 mg**	**15.7**
Vitamin B5	**1.1 mg**	**13.2**
Vitamin B6	**0.14 mg**	**6.5**
Vitamin B7	**3.98 µg**	**8.0**
Vitamin B9	**131 µg**	**24.6**
Vitamin B12	**<0.01 µg**	**-**
Vitamin C	**1.4 mg**	**1.4**
Vitamin D3	**<0.5 µg**	**-**
Vitamin E	**<0.08 mg**	**-**

	Ricebean content per 100 g	% of RDI /DRA/AI of 60 g/day
Ca	264 mg	15.8
P	124 mg	10.6
Mg	73 mg	13.7
K	2875 mg	36.7
Na	6 mg	0.3
Fe	6.7 mg	22.3
Zn	3.1 mg	23.5
Cu	1.5 mg	97.3
Mn	2.7 mg	90.0

Nutrient content of ricebean compared to eight other pulses

Source: Food composition Database,

Dept. of Food and Nutrition, School of Life Studies, Sugiyama Jogakuen University

based on "Standard Table of Food Composition in Japan, Fifth revised edition”, Resources Council of the Science and Technology Agency of Japan

Pulse/nutrient	Soybeans	Mung beans	Lima beans	Broad beans	Azduki beans	Kidney beans	Lentils	Scarlet runner beans	Av. of eight pulses	Rice beans	Substantial difference
Energy, kJ	1745	1481	1460	1456	1418	1393	1477	1389	1477	1448	
Energy, kcal	417	354	349	348	339	333	353	332	353	346	
Water, g	12,5	10,8	11,9	13,3	15,5	16,5	11,4	15,4	13,4	12,3	
Protein, g	35,3	25,1	22,9	26	20,3	19,9	23,2	17,2	23,7	20,3	
Lipid, g	19	1,5	1,8	2	2,2	2,2	1,3	1,7	4,0	1,6	Lower
Carbohydrate, g	28,2	59,1	59,6	55,9	58,7	57,8	61,3	61,2	55,2	61,8	
Ash, g	5	3,5	3,8	2,8	3,3	3,6	2,8	4,5	3,7	4	
Sodium, mg	1	0	Tr	1	1	1	Tr	1	0,8	1	
Potassium, mg	1900	1300	1900	1100	1500	1500	1000	1700	1488	1400	
Calcium, mg	240	100	75	100	75	130	58	78	107	290	Higher
Magnesium, mg	220	150	170	120	120	150	100	190	153	230	Higher
Phosphorus, mg	580	320	200	440	350	400	440	430	395	340	
Iron, mg	9,4	5,9	6,1	5,7	5,4	6	9,4	5,4	6,7	12,5	Higher
Zinc, mg	3,2	4	5,5	4,6	2,3	2,5	5,1	3,4	3,8	3	Lower
Copper, mg	0,98	0,91	0,75	1,2	0,67	0,75	0,96	0,74	0,87	0,74	
Manganese, mg	1,9	0	0	0	0	0,54	1,69	1,5	0,70	2,7	Higher

	Soybeans	Mung beans	Lima beans	Broad beans	Azduki beans	Kidney beans	Lentils	Scarlet runner beans	Av. of eight pulses	Rice beans	Subs. diff.
Retinol, ug	0	0	0	0	0	0	0	0	0	0	
Carotene, ug	6	150	0	5	7	12	28	4	27	22	
Retinol eq. ug	1	25	0	1	1	2	5	1	5	4	
Vitamin D, ug	0	0	0	0	0	0	0	0	0	0	
Vitamin E, mg	3,6	0,9	0,5	1,2	0,6	0,3	1,4	0,4	1,1	0,7	Lower
Vitamin K, ug	18	16	6	13	8	8	14	8	11	28	Higher
Vitamin B1, mg	0,83	0,7	0,48	0,5	0,45	0,5	0,55	0,67	0,59	0,46	Lower
Vitamin B2, mg	0,3	0,22	0,18	0,2	0,16	0,2	0,17	0,15	0,20	0,14	Lower
Niacin, mg	2,2	2,1	1,9	2,5	2,2	2	2,5	2,5	2,2	1,7	Lower
Vitamin B6, mg	0,53	0,52	0,41	0,41	0,39	0,36	0,54	0,51	0,46	0,25	Lower
Vitamin B12, ug	0	0	0	0	0	0	0	0	0	0	
Folate, ug	230	460	130	260	130	85	59	140	187	180	
Pant. acid, mg	1,52	1,66	1,26	0,48	1	0,63	1,77	0,81	1,14	0,35	Lower
Ascorbic acid, mg	Tr	Tr	Tr	Tr	Tr	Tr	Tr	Tr	Tr	Tr	

Significance when promoting ricebean as *subsistute* pulse

- no allergenic, toxic substances
- significantly better source of minerals *Ca, Mg, Fe (?)* but not quite of Zn
- lower in some B vitamins (good in vit.K)
- one of the best amino acid compositions
- low fat (for better or worse); good composition
- high phytic acid → precooking methods important

Dietary survey, study design

- Overview of dietary pattern
- Quick snapshot
- 3 x 24 h dietary recalls, 4 x 200 women, 20-40 years - seasonality
- Four teams: Dolakha, Gulmi, Assam, Palampur-Himachal Pradesh
- Food models

24-HOUR DIETARY RECALL FORM

I.DATE 11.05.01 III.RECALL NO. II

IV.AGE 31

II.ID NO 284 V.WEIGHT 52 kg

VI.TIME	VII.FOODS ITEM	VIII.AMOUNT	IX.DATA ENTRY	X.REMARKS
5.30	चिया	200 ml.	Milk - 50 ml	
	रोटी	$\frac{1}{2}$ (L)	Sugar - 10 gr.	
			W. flour, local - 45 gr.	
900	भात	2 (L) bowl	Rice - 220 gr.	
	हरीयो सागु पालुङ्गो	1 (S)	Spinach - 200 gr.	
			Leaf, Coriander - 8 gr.	
	अचार - चार्मेवा	2 चम्चा (S)	Oil - 1.5 ml	
	तेल - 2 चम्चा / 6 ml			
			W. flour - 90 gr.	
1400	रोटी	1 (L)	Local beers - 400 ml	
	चिया	400 ml		
			Rice - 165 gr.	
1900	भात	1 $\frac{1}{2}$ (L)	Spinach - 100 gr	
	हरीयो सागु पालुङ्गो	$\frac{1}{2}$ (S)	Oil - 1.5 ml	
	तेल -	2 चम्चा / 6 ml		

XII.SUPERVISOR SIGNATURE

XIII.DATA ENTRY I

XIV.DATA ENTRY II

Sources of error in dietary survey

- 24 hours recall – memory
- opportunistic answers
- food models
- match of local foods til food table categories
- food table errors – dry or wet weight
- typing errors
- major cautions: food tables; HP staples; Assam staples and meat; rough measure of pulses

What are the diets?

Dolakha:

Dal Bhat + maize and wheat, some non-veg.

Gulmi:

Dal Bhat + more maize and wheat, some non-veg.

HP:

Rice / wheat + dal + more pulses, vegetarian

Assam:

Rice, leafy vegetables, fish, pork + pulses

Staples frequency out of 600 recalls in

	Dolakha	Gulmi	Palampur	Assam
Rice	572	424	554	558
Beaten rice	172	23		
Wheat and bread	107	175	608	24
Maize flour	164	155	16	2
Green maize	62	121		21
Millet	63	68		
Noodles, pasta	28	31	2	

Importance of food groups in the total energy supply, mean of all sites; (pulses probably underestimated)

- rice 63.6 %
- wheat 8.3%
- maize 6%
- potatoes 2.7%
- milk 2.6%
- pulses 2.3 %
- vegetable oil 2.0%
- sugar 1.3%.

Frequency of pulses recorded in 600 recalls in

	Dolakha	Gulmi	HP	Assam
Lentil	200	133	445	340
Field bean	138	193	13	13
Cowpea	77	153	6	29
Chickpea	8	6	232	
Pigeon pea	47	69	37	8
Ricebean	29	12	80	23
Soybean, raw	60	15	16	11
French bean	17	4	37	5
Soybean, black	29	6	6	21
Mung bean	4		56	
Horsebean	7	1	2	

Dietary provision and requirements

	Dolakha	Gulmi	Assam	HP	Recommended values
Energy kcal	1842	2110	2200	1267	(2000)
Protein g	45	55	55	43	38 (EAR) (50 preg.)
Folate ug	211	230	265	230	400 (600 preg.)
B12 ug	0.6	1.1	0.7	0.6	2.4 (2.6 preg.)
Ca mg	392	468	353	335	1000 (AI)
Fe mg	9.4	10.2	10.2	8.8	18 (27 preg.)
Zn mg	7.3	9.5	8.1	8.1	8 (11 preg.)

Nutritional problems forecasted and window of opportunity for ricebean

Reasonably sufficient:

- Energy
- protein
- essential amino acids
- most vit. Bs
- P, Mg, Zn, Cu, Mn

Low intake

- fats
- vit. A, C, D, E
- *vit. B9*, B12
- *Ca*
- *Fe*
- *K*

Sources of amino acids

	% from rice	% from wheat	% from pulses
Tryptophane	**42.7**	**15.7**	**5.8**
Threonine	**43.4**	**9.7**	**7.1**
Isoleucine	**44.4**	**10.6**	**6.7**
Leucine	**44.9**	**10.1**	**6.1**
Lysine	**33.8**	**7.1**	**8.7**
Methionine	**48.8**	**8.9**	**3.6**
Cystine	**53.0**	**16.5**	**4.7**
Phenylanaline	**48.6**	**11.9**	**6.5**
Tyrosine	**43.9**	**10.6**	**5.2**
Valine	**48.5**	**9.9**	**5.8**
Arginine	**54.3**	**8.5**	**8.0**
Histidine	**41.4**	**11.3**	**7.4**

Vitamin	Main source in dietary recalls	% of supply from pulses
A	Leafy vegetables, milk	1 %
B_1	Rice, wheat, maize	8.4 %
B_6	Rice, potato, wheat, maize	4.4 %
B_9	Leafy vegetables, lentils, rice	26.7 %
B_{12}	Milk, fish, red meat	0 %
C	Leafy vegetables, potato	4.9 %
D	Fish (86 %), pork	0 %
E	Leafy vegetables, wheat, maize	3.9 %

Mineral	Main source in dietary recalls	% of supply from pulses
Ca	Milk, leafy vegetables	5 %
P	Rice, wheat, milk, maize	8.4 %
Mg	Rice, wheat, maize	5.5 %
K	Rice, potato, wheat, milk	8.8 %
Fe	Rice, wheat, mixed spices, maize, pulses	11.6%
Zn	Rice, wheat, maize	6.1%

Final conclusion

- Pulses are important for some amino acids and micronutrients
- Ricebean and other pulses particular potential to improve B9, Ca, Fe and K status (important during pregnancy)
- Ricebean a unique source of Ca!
- Ca in 100 g ricebean ~ 250 g milk
- In addition: indirect benefits: drought security, N fixation, fodder, erosion control etc.

Need for future research

- How food security relates to cropping pattern, farming system, other livelihoods
- Substitution between pulses
- Seasonality and food stores
- Local processing
- Storage
- Preferences, organoleptic qualities