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Food Security through Ricebean Research in India and Nepal

Report 4: Nutritive value of ricebean

Report on the nutritive value of ricebean

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Executive summary

The present report contains a review of existing literature on the nutritive value of ricebean *(Vigna umbellata)*, supplemented by chemical analyses of selected nutrients. It is found that ricebean has a number of favourable characteristics in comparison with many other pulses. The protein content is in a normal range, but with a high digestibility and a very favourable amino acid composition for human consumption. The content of B vitamins is good, especially thiamine, riboflavin, niacin, pantotenic acid and folate, but it is not an important source of other vitamins. It is a good source of many minerals, including calcium, phosphate, potassium, iron and zinc. Compared to recommended daily requirements, the consumption of a realistic amount of ricebean can provide very considerable amounts of protein, all essential amino acids, the mentioned vitamin B's and minerals. The content of fats is very low, and with a healthy fatty acid composition. There are no toxins or allergenic compounds linked to ricebean, and the content of enzyme inhibitors is low compared to most other pulses. The content of other antinutrients such as phytate is also moderate compared to other pulses, and the levels reduced by common cooking methods. Likewise, ricebean contains less flatulence producing saccharides than many other pulses. Ricebean is having local cultural roles, but generally there has not been found any cultural rules restricting its use.

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1. Introduction

The present report is an output of work carried out under FOSRIN WP5 Nutrition and Health. The major part of the work on nutrient content is based on literature reviews, supplemented by laboratory analyses. The author gratefully acknowledges input from Nepalese geographers on the cultural role of ricebean in Nepal, with especial thanks to Bipin Acharya, Prem Sagar Chapagain, Keshav Paudel and Gitta Thapa.

The report is to be followed by more results from the dietary survey which has been the bulk of the work in WP5, based on dietary recalls from 800 women in four locations in Nepal and India.

The purpose of this report is to document and supplement the present knowledge of the nutritive value of ricebean. It is primarily based on a review of existing literature. However, these reports are commonly based on a limited number of samples and varieties. Since considerable difference between varieties and growth conditions are most likely to be present, the values reported should be read as indicative. In reality, it is reasonable to assume that there will be a rather broad band of several nutrients. In addition to literature reviews, some supplementary testing has been carried out.

Although it is rather dangerous to generalise about the diets and nutrition of the more than one billion people who live in Nepal and India, the importance of pulses as a central food item in South Asia cannot be dismissed. The majority of people of the region are in principle non-vegetarians, but widespread poverty means that the consumption of animal source foods, and especially of meat, is very low compared to the rest of the World. As a result, pulses have an important role as a source of essential nutrients, especially protein, some vitamins, and minerals. Throughout Northern India and Nepal, a common main meal will consist of a staple (rice [*Oryza sativa*], wheat [*Triticum aestivum*] or maize [*Zea mays*]), a vegetable curry and a *dal* – (often split) pulses cooked as a soup which is served as a sauce as well as providing an important source of nutrients. In addition, various pickles can be served as well as dairy produce. With respect to pulses, there is considerable elasticity in demand as they are expensive compared to cereals. From 1969-1971 to 2001-03, the consumption of pulses fell in Nepal from 23 to 22 g *per capita*, and in India from 45 to 32 g (FAO, 2009). While both general food security and protein consumption have improved in the region, there remain large disparities between social groups. So, while the middle class may have improved its diet by increasing the intake of pulses as well as of dairy produce and meat, the poorer population segments have seen the nutrient density of their diets reduce.

Recent figures for *per capita* meat consumption in Nepal was 10.3 kg and in India 4.6 kg (Speedy, 2003). This low figure is to some extent compensated for by consumption of milk, in Nepal 30.4 kg and in India 47.5 kg. Annual fish consumption in Nepal is 2 kg and in India 7.1 kg (Ibid.) In terms of protein supply, an increased consumption of wheat and less reliance on rice as a staple food has impacted the balance positively (Table 1.1).

Table 1.1: Different food groups' share of protein supply, %.

	Nepal		**India**	
	1969-71	2001-03	1969-71	2001-2003
Cereals	71	66	52	56
Pulses	9	6	19	11
Meat and dairy	11	9	10	16

Source: FAO (2009)

Ricebean (*Vigna umbellata*) is most often served as a *dal*, either soaked overnight and boiled with a few spices, or cooked in a pressure cooker. Apart from various recipes for *dal* soups and sauces, pulses are also used in a number of other ways, either whole, cooked or roasted, as flour, or ground to make various deep fried dishes or snacks. Some recipes are specific to specific pulses, but many are open to substitution between different pulses. Field demonstrations of ricebean dishes carried out in the FOSRIN project have shown that ricebean is versatile as a raw material for many preparations, and it has successfully been introduced in a number of field locations. The consumption of green pods as a vegetable has been recorded but is not widespread. However, this use should be encouraged since the indeterminate habit of many varieties is beneficial in providing a steady supply of green pods over long periods of the year.

Indirect nutritional benefits that can be obtained from ricebean relate to its value as a high class fodder which is known to increase milk production in livestock, its ability to fix nitrogen in depleted soils and in mixed cropping with local varieties of maize, as well as its beneficial role in preventing soil erosion.

2. Nutrient content

2.1 Protein content and digestibility

The raw protein content of ricebean cultivars appears to be lower than of most other pulses, although there is considerable variation in the figures presented in the literature (Table 2.1.1).

Table 2.1.1: Protein content according to various authors

Authors	**Crude protein %**
Malhotra *et al*, 1988	17.5 - 23.1
Mohan & Janardhan, 1994	21.9 - 26.1
Saikia *et al*, 1999	16.9 - 18.0
Rodriguez & Mendoza, 1991	17.3 - 21.4
Saharan *et al*, 2002	18.2 ± 0.2
Duke, 1981	20.9
FAO, 1982	18.5
Chandel *et al*, 1978	14.0-24.0
Kaur & Kapoor, 1992	17.2 – 18.5
Overall range	14.0-26.1

Gopinathan *et al* (1987) note that the protein content of related wild species (e.g. *Vigna minima*) tends to be higher than of cultivated lines, so there may well be breeding potential for improved protein content within the wild gene pool. However, there is as yet no specific information on this in ricebean.

Although the protein content may be in the lower range of pulses, the amino acid composition is reported by several authors to be well balanced for human consumption. Chandel *et al* (1978: 21) noted that *"The amino acid composition, especially the more limiting ones, methionine and tryptophan is considerably high"*.

Carvalho & Vieira (1996) stated that ricebean is particularly rich in methionine and tryptophan, with a reference to Chatterjee & Mukherjee (1979).

According to Mohan & Janardhan (1994), the methionine levels of ricebean are higher than for blackgram (*Vigna mungo*) and mungbean or green gram (*Vigna radiata*). The threonine values of some of varieties are rather low compared to FAO/WHO commendations for human intake. However, the contents of lysine, tyrosine and valine are more or less equal to the content of comparable species. They concluded that *"all the varieties of Vigna umbellata seem to be a good source of protein, essential amino acids, essential fatty acids and minerals"* (Ibid.: 262)

Rodriguez & Mendoza (1991) analysed the amino acid content of three ricebean accessions, and found comparable values to those of Mohan & Janardhan (1994). They also assessed the *in vitro* protein digestibility of both the albumin fractions and the raw seed meals, and found that the albumin fractions were 86.1-88.5 % digestible, close to albumin standards. The raw seed meal digestibility of 82-85 % was slightly higher than that of mungbean, and substantially higher than cowpea (*Vigna unguiculata*), and of indigenous legumes from the Philippines. Table 2.1.2. presents some studies of amino acid profiles in ricebean.

Table 2.1.2: Amino acid composition per 100 g protein

Amino acid g/100 g protein	**Range of six varieties, Mohan & Janardhan 1994**	**Ricebean variety IC 1568 Gopinathan *et al* (1987)**
Glutamic acid	12.36-15.23	17.0
Aspartic acid	10.39-12.86	13.5
Serine	3.03-5.01	5.6
Threonine	2.02-4.18	4.1
Proline	2.54-8.36	3.6
Alanine	3.26-5.50	6.6
Glycine	2.96-4.26	3.8
Valine	5.06-5.89	4.4
Cystine	Traces	1.0
Methionine	1.58-2.88	0.9
Isoleucine	3.33-6.21	4.6
Leucine	5.82-8.34	7.8
Tyrosine	2.12-3.31	3.2
Phenylanaline	3.02-5.23	5.5
Lysine	5.38-6.31	7.7
Histidine	2.39-5.83	3.3
Tryptophan	Not detected	Not detected
Arginine	4.31-7.12	6.3

In a study by Mal (1994), the tryptophan level ranged from 0.79-1.10 % of the seed protein, or a median value of 0.95. There are no other recorded measures for tryptophan, possibly because, although essential, it commonly accounts for only about 1% of the total amino acid content, and also requires a separate analysis for its determination (Marit Espe, personal communication[1]). However, as stated above, some articles do claim that the tryptophan content is favourable (Chandel *et al,* 1978; Carvalho & Vieira, 1996).

The *in vitro* digestibility of protein of the whole seeds was reported by Saharan *et al* (2002). They found it to be 58.4 %.

2.2 Vitamins

Relatively little is reported in the reference literature concerning other vitamins than the vitamin B complex. A reason for this is, of course, that several vitamins are only found in specific food items, such as the vitamins B_{12} and D which are only found in animal source foods. The preliminary results of the dietary recalls carried out under WP5 (Table 2.2) give an indication of the importance of various food items in the provision of different vitamins.

Some sporadic measurements of vitamin content have been found in the literature. Carvalho & Vieria (1996) wrote that ricebean is particularly high in thiamine, niacin and riboflavin. Kaur & Kapoor (1992) measured an average of 30 mg niacin and 1.4 mg ascorbic acid in five different varieties. No reports have been found documenting the folate content of ricebean. On

[1] Marit Espe, Senior Scientist, Norwegian Institute of Nutrition and Seafood Research, Bergen

the basis of the lacking evidence from literature sources, it was decided to include a laboratory analysis, especially aimed at the vitamin B complex. The data have been included in Table 3.1.

Table 2.2: Food items as sources of some vitamins

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 %

Source: Dietary surveys conducted in WP5 in Nepal and India.

2.3 Mineral content and related antinutrients

Duke (1981) gave the following figures for mineral content per 100 g: 200 mg Ca, 390 mg P, and 10.9 mg Fe. No information was given on varieties or agronomy. Kaur & Kapoor (1992) measured mineral content of 5 different varieties of ricebean, on a dry matter basis (crushed, dry beans). The calculated mean values are given in Table 2.3 (Total/extractable):

Table 2.3: Content of some minerals

Calcium		**Phosphorus**		**Iron**		**Zinc**		**Copper**		**Manganese**	
Total	Ext.	Total	Ext.	Total	Ext.	Total	Ext.	Total	Ext.	Total	Ext.
306.8	265.4	241.8	80.6	6.7	5.7	3.1	2.0	1.5	0.9	2.7	2.0

Source: Kaur & Kapoor (1992)

As in other pulses, an important problem with ricebean is that it contains various antinutrients, notably phytic acid or phytate, polyphenols and fibres that reduce the uptake of several micronutrients. This is especially important for Fe and Zn. Breeding for low phytate seeds is possible, but there are conflicting opinions about the desirability of this because phytate is also a human nutrient, and because it plays various roles in the life cycle of the plant. Chandel *et al* (1978) stated that phytate was low in ricebean. Malhotra *et al* (1988) reported polyphenols to be 900 mg/100g, lower than that in other '*standard crops – cowpea, moong, mash*'. Kaur & Kapoor (1992) found between 1279 and 1587 mg polyphenols per 100 g in five varieties.

Saikia *et al* (1999) found from 1998 to 2170 mg phytic acid / 100 g uncooked seeds, but substantial reduction after pressure cooking or boiling. Saharan *et al* (2002) measured 2018 ± 5.9 mg / 100 g. Kaur & Kapoor (1992) found between 1875 and 2270 mg phytic acid in their five varieties. These values appear very consistent.

Kaur & Kawatra (2002) studied the bioavailability of zinc as affected by different cooking methods: soaking, sprouting, dehulling and pressure cooking. The study contained chemical analysis of various antinutrients, among which was phytate. Whole raw ricebean contained 132.7 mg phytin phosphorus / 100 g, soaked and pressure cooked 103.0 mg, sprouted and pressure cooked 95.2, roasted 118 mg, dehulled raw 115.2 mg, and dehulled and soaked 92.8. The bioavailability was checked with rat trials, measuring body weight gain, zinc content and retention in rat femur, liver, kidneys and spleen as well as plasma. A control food with standard zinc sulphate ($ZnSO_4$) was included in the rat study. All the preparations increased the bioavailability of zinc. The highest availability was obtained by sprouting and pressure cooking, but dehulling, soaking and pressure cooking gave a similar femur zinc concentration.

Saharan *et al* (2001) compared the bioavailable content of Ca, Fe and P in ricebean and fababean (*Vicia faba*) and how it was impacted by soaking and sprouting. Available Ca increased from 59.8 % in raw ricebean to 62.1 % after soaking and 67.5 % after sprouting (24h). The available Fe fraction increased from 37.9 % in raw to 39.3 % in soaked and 41.5 % in sprouted ricebean. Extractable P moved from 33.4 % in raw to 37.7 % in soaked and 38.8 % in sprouted ricebean. The effects on fababean were similar.

Longvah & Deosthale (1998) tested ricebean from the goitre-endemic northeast region of India for iodine content and found a mean of 9.1 ± 2.9 µg / 100 g. This was lower, in some cases considerably so, than the iodine content of soybean (*Glycine max*), field bean, green gram, cowpea, black gram and red gram (pigeon pea, *Cajanus cajan*). However, most strategies for increasing the iodine intake of susceptible populations concentrate on iodisation of salt, which in most cases is effective.

2.4 Oligosaccharides

Special concern for flatulence-producing substances is important when a pulse is promoted for human consumption since this is a common drawback restricting the use of pulses (Smil, 1997). Revilleza *et al* (1990) tested the content of known flatulence-producing oligosaccharides in common legumes from the Philippines and ranked the crops based on their flatulence-producing potential: Sam-samping (*Clitoria ternatea*) > hyacinth bean (*Lablab purpureus*, syn. *Dolichos lablab* L) > Lima bean (*Phaseolus lunatus*) > swordbean (*Canavalia gladiata*) > ricebean > jack bean (*Canavalia ensiformis*). Two different varieties of ricebean contained 2.25 and 2.55 % oligosaccharides. Kaur & Kawatra (2000) checked the content of raffinose and stachyose of one cultivar of ricebean (RBL-6) and found 1.48 % raffinose and 3.29 % stachyose in the raw bean.

The effect of soaking, open pan cooking, pressure cooking, sprouting and combinations of these were measured. Any of these common cooking methods led to a significant reduction of the content of flatus-producing sugars; the most effective was a combination of sprouting and pressure cooking which reduced the content of raffinose to 0.29 % and stachyose to 0.68 %. Roasting was less effective in reducing oligosaccharides.

2.5 Fats

Generally, ricebean is a very low fat food. Saikia *et al* (1999) found 0.46-0.52 % crude fats (fatty acids and fat soluble constituents) in uncooked ricebean. Saharan *et al* (2002) reported 0.83 ± 0.2 g fats / 100 g, and Kaur & Kapoor (1992) found between 0.44 and 0.56 g / 100 g in five different varieties.

According to Duke (1981), the composition of fatty acids can be (%): myristic 6.3-7.3, palmitic 5.6-6.0, stearic 2.1-4.4, behenic 4.6-5.8, arachidic 3.0-3.9, lignoceric 2.9-3.2, linoleic 7.5-9.7 and oleic 61.3-68.0. Rounded off to the mean value of the intervals, this can be categorised as: saturated fats: 27.4 %, monounsaturated: 64.6 %, and polyunsaturated: 8.6 %

The figures from Kaur & Kapoor (1992) are rather different since they found the saturated palmitic acid content to range from 40.5 – 44.6 % and up to 55.0 % saturated fats in total. Their range of oleic acid was only 11.0 – 13.4 % of total fats and the level of unsaturated fats 36.1 – 49.5 %

The discrepancy between the figures of Duke (1981) and Kaur & Kapoor (1992) is so large that it is likely to due to different methods or classifications applied by the authors. Since the composition of fatty acids in low fat pulses vary considerably, it is not obvious which composition to expect. If anything, the total level of unsaturated fats is on the healthy side, and it is clear that the total fat content is low and ricebean is not an important source of fats in normal diets. A daily intake of 50-60 g will provide less than 0.5 g of fats.

In addition, the content of saponin is likely to play a role in reduction of blood cholesterol (Kaur & Kapoor 1992).

2.6 Enzyme inhibitors

While most legumes contain one or several enzyme inhibitors and similar antinutritive or toxic factors (Smil, 1997), the content of such substances appears to be low in ricebean.

Malhotra et al. (1988) found trypsin inhibitor activity (TIA) to be between 113 and 164 units per g in thirteen varieties, and noted that this was similar to other pulses. Kaur & Kapoor (1992) measured the trypsin inhibitor activity as between 35 and 49 units per g in five varieties. The reason for this vast difference is not obvious but probably methodological. Both were based on raw seeds. Saikia *et al* (1999) found higher TIA in raw seeds but noted that it is largely destroyed by cooking and conclude that it “should not pose a problem in human consumption if the beans are properly processed” (Ibid., p. 352).

Haemaglutinating activity was checked by Malhotra *et al* (1988) who found low activity compared to other pulses. Kaur & Kapoor (1992) only note that it is ‘present’.

Benjakul *et al* (2001) were looking for alternative proteinase inhibitors for fish conservation, and found that ricebean contained Cystein Proteinase Inhibitors (CPI) that are quite thermostable.

3. Nutrient content compared to recommended values

Table 3.1 is based on a selection of nutrients analysed in Worldfood2, and how this compares to the recommended values for adult women, based on National Academy of Sciences reference values (NAS, 2002). For most of the nutrients, the recommended values are the Recommended Daily Allowances (RDA) which is “the amount of a nutrient which should be provided per head of population group, if the needs of practically all people in that population are to be met” (Ibid.). Thereby it is calculated as the Estimated Average Requirement (EAR) + 2 SD, so that 97-98 % of the population theoretically should have their requirements covered. For a few nutrients, Ca, Mn, P and Na, the RDA is not available, and the value applied is the Adequate Intake (AI).

The choice of women of reproductive age for the dietary analysis was based on the assumption that this group is particularly at risk in terms of deficiencies of various nutrients (Gittelsohn *et al,* 1997). However, Webb (2002) has found that the evidence for this is conflicting to some extent, among others because intra-household food distribution is managed of by women.

The calculations are based on an intake of 60 g ricebean per day, a scenario of the potential of enhanced pulse provision. Currently the consumption of pulses in South Asia is about 30 g *per capita* per day. There can be large variations from this figure, but field measurements show that the desired amount tends to be around twice that: 30 g of pulses per person per serving (two main meals a day). In a study from Kathmandu Valley, Ohno *et al* (2005) found the mean daily consumption of pulses among adult men to be 27 g, while adult women consumed 21 g. A study from Itahari in South East Nepal by Hirai *et al* (1994) showed a mean daily consumption of 41 g of pulses among males, but 48 g among women.

The amino acids are recalculated based on the average true protein content reported by Mohan & Janardhan (1994). The RDI for amino acids are calculated on the basis of an average body weight of 49 kg which was found in the dietary survey. The values are basically the total content, not the bio-available, which will tend to be lower. This will particularly be the case for Fe and Zn which are affected by phytate and other anti-nutrients. Breakdown of heat-labile nutrients will also lead to a lower real contribution of some factors, notably the vitamins. Since ricebean commonly is consumed as *dal*, the nutrients dissolved in cooking water are not lost.

Table 6: Potential provision of nutrients as % of recommended intake for adult women.

Nutrient from Wfood2 list	**Nutrient content units / 100 g bean**	**Reference**	**% of RDA or AI) at consumption of 60 g/day**
Total protein	18 g	Kaur & Kapoor, 1992	28.4
Threonine	0.536 g	Mohan & Janardhanan, 1994	32.8
Isoleucine	0.942 g	Mohan & Janardhanan, 1994	60.7
Leucine	1.304 g	Mohan & Janardhanan, 1994	38.0
Lysine	1.074 g	Mohan & Janardhanan, 1994	34.6
Methionine + cysteine	0.421 g	Mohan & Janardhanan, 1994	27.1
Histidine	0.648 g	Mohan & Janardhanan, 1994	56.7
Tryptophane	0.171 g	Mal, 1994	56.7
Phenylanaline + tyrosine	1.349 g	Mohan & Janardhanan, 1994	50.0
Valine	1.022g	Mohan & Janardhanan, 1994	312.0
Fibres	7.0 g	Kaur & Kapoor, 1992	9.3
Vitamin A (retinol)	<21µg	*EUROFINS	-
Vitamin B1 (thiamin)	0.49 mg	Duke, 1981	32.6
Vitamin B2 (riboflavin)	0.31 mg	Kaur & Kapoor, 1992	34.4
Vitamin B3 (niacin)	2.88 mg	*EUROFINS	15.7
Vitamin B5 (pantotenic acid)	1.1 mg	*EUROFINS	13.2
Vitamin B6 (pyridoxine)	0.14 mg	*EUROFINS	6.5
Vitamin B7 (biotin)	3.98 µg	*EUROFINS	8.0
Vitamin B9 (folate)	131 µg	*EUROFINS	24.6
Vitamin B12 (cobalamin)	<0.01 µg	*EUROFINS	-
Vitamin C	1.4 mg	Kaur & Kapoor, 1992	1.4
Vitamin D3	<0.5 µg	*EUROFINS	-
Vitamin E	<0.08 mg	*EUROFINS	-
Ca	264 mg	Mohan & Janardhanan, 1994	15.8
P	124 mg	Mohan & Janardhanan, 1994	10.6
Mg	73 mg	Mohan & Janardhanan, 1994	13.7
K	2875 mg	Mohan & Janardhanan, 1994	36.7
Na	6 mg	Mohan & Janardhanan, 1994	0.3
Fe	6.7 mg	Kaur & Kapoor, 1992	22.3
Zn	3.1 mg	Kaur & Kapoor, 1992	23.5
Cu	1.46 mg	Kaur & Kapoor, 1992	97.3
Mn	2.70 mg	Kaur & Kapoor, 1992	90.0

*EUROFINS refers to laboratory analysis at the Danish EUROFINS laboratory which is accredited for the analysis. The figures refer to one accession of *pahelo marsyang* – a yellow variety from Nepal.

4. Cultural role of ricebean

In South Asia, the idea of a division of foods into hot, cold and neutral is very common. This has an important bearing on dietary choices, as this perception not only promotes a balance between hot and cold food stuffs in daily nutrition, but also encourages or discourages the consumption of various items according to season, and during sickness. An interesting account of the perception of a number of food items in Nepal has been published by Gittelsohn *et al* (1997). Their data shows that there is hardly any "scientific" basis for the division into hot and cold foods. For instance, yogurt is cold while goat milk is hot, buffalo meat is cold while fish and chicken is hot, and black gram is cold while red gram is hot. It should be noted that this perception tends to be location-specific, so the findings from Gittelsohn *et al* (1997) cannot be generalised all over Nepal (or South Asia!). Their study has not captured anything about the hot-cold rating of ricebean.

Local knowledge about ricebean (Khanal & Poudel, 2009) in Nepal tends to categorise it as a cold food (Gulmi, Kailali, Sangya, Dang, Gorkha) and reports that it makes you cool in the summer. However, there are also accounts that it makes you warm during the winter, so the categorisation is apparently not very strong with respect to ricebean. In Ilam district in Eastern Nepal, ricebean is considered as hot, and there it is advised that old and sick people should not eat it during the hot season, as it is not easily digested and weak people would get stomach problems from eating it.

Another account from Ilam stated that ricebean, although creating some stomach unrest, was milder and more digestible than other pulses, and therefore often served to people who suffer from indigestion. Whether hot or cold, the major share of ricebean is consumed soon after harvest, so the crop will *only indirectly impact on food security during the lean season in the pre- and early monsoon period.*

Other oral evidence from Nepal says that ricebean does not have a particular ceremonial role. This is in contrast to black gram which is used for ceremonial purposes among high caste Hindus, and also for instance among Rai people in the Arun Valley. In addition, black gram is considered tastier and fetches a higher market price, so will tend to replace ricebean if the farmer has to make a choice.

Quantee (or *kwati* in Newari) is a mixed bean sprout soup served at the *Janai Purnima* or *Raksha Bhandan* festival. Ricebean is one of nine beans prescribed for this recipe. The festival marks the end of the monsoon where people by traditional perception (and probably also in reality) have been weak, undernourished and subject to diseases. In this respect, *quantee* is said "to make one strong" and to purify the stomach as the mixed bean sprouts are hard to digest and so cleans the stomach. In addition, eating *quantee* is said to kill a certain type of mosquito (Löwdin, 1998).

Unlike China, no information has been found regarding any "folk medicine" use in Nepal or India. According to Wikipedia (2009),

"In traditional Chinese medicine (TCM), the red type rice beans help to relieve edema in some illness; they are also used in combination with Angelica sinensis to remedy red eyes (possibly uveitis) with erosion of oropharyngeal or urogenital mucosae, which was suspected to be Behçet's disease in modern points of view."

While ricebean in Nepal to some extent is perceived as a "poor man's food", it is not particularly stigmatised, so no ethnic or caste group actually has a rule against it. In Dang, ricebean is particularly enjoyed by *Tharu* (indigenous *Terai*) people, who have a version of *quantee* which requires ten different beans.

One source mentioned that since ricebean is supposed to make you strong, people will often serve it to labourers, while also occasionally consuming it themselves in connection with tasks requiring hard work.

5. Conclusion

As a source of nutrients, ricebean has a number of very favourable characteristics. Although the protein content in many reports tends to be in the lower range compared to other pulses, the bioavailability is high and the amino acid composition is very favourable for human consumption. Therefore it is especially well suited both as an alternative to, and as a supplement to scarce animal source foods among economically marginalised people. In addition, the levels of thiamine, niacin, riboflavin, folate and pantotenic acid are high, and it provides sizeable amounts of important minerals such as Ca, P, Mg, K, Fe, Zn, Cu and Mn.

The level of anti-nutrients is modest compared to other pulses, and is reduced by common cooking practices, in particular soaking or sprouting. Ricebean contains very little fat, with a high proportion of unsaturated fatty acids. There are no indications of toxins or of allergenic substances in the crop. The level of flatulence-producing factors is low compared to many other pulses.

With respect to cultural acceptance, ricebean is not specifically stigmatised or subject to food taboos but has a potential to be promoted as a high quality food.

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