

Nutrient Composition of Some Regional Recipes of Assam, India

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ABSTRACT Assam is a north eastern state of India with a typical food habit distinct from the rest of the country. In order to document the nutrient composition of the regional recipes of Assam, some of the recipes were analyzed for proximate composition, calcium, iron, β -carotene/retinol, and vitamin C. In the present study, few recipes from green leafy vegetables, other vegetables, fish and meat were included. A wide range of variations in the nutrient contents of the recipes were observed in most of the cases. Moisture content ranged from 29.3 ± 1.00 g/100g in *Boriola mas bhoja* (R20) to 89.6 ± 0.12 g/100g in *Mandhanian chutney* (R3). Protein content of most of the fish and meat based recipes were higher than the vegetable based recipes. Fat content of stir fried vegetables and most of the fish and meat based recipes were higher than the other recipes. Highest total mineral content was observed in *Boriola mas bhoja* (R20) amounting 8.8 ± 1.11 g/100g. Comparatively higher crude fibre contents were found in *tita Kerela bhaji* (R14) and *Bhat kerela bhaji* (R15) amounting 6.5 ± 0.30 g/100g and 12.6 ± 0.04 g/100g respectively. In many of the vegetable preparations, calcium and iron contents were comparable with the preparations from fish and meat. Considerable amount of β -carotene was observed in *Morisa sak bhaji* (R6) amounting 2278.0 ± 140.36 μ g/100g. The study was an initial approach in developing nutrient database of regional Assamese recipes.

INTRODUCTION

The importance of food composition database has been recognized by all levels of governments, consumer organizations and individual consumers throughout the world (Vanderveen and Pennington 1983; Beecher and Vandeslice 1984; Greenfield and Southgate 1992; Dwyer 1994; Samuda et al. 1998). This is because food composition database has applications in varied fields of public health like, assessing and monitoring food and nutrient availability and intakes of a population, diet and disease inter-relationships, health education and promotional activities, preserving and documenting traditional foods and related aspects (Harrison 2004).

The ideal food composition database would provide data on all foods and food components of interest to entire spectrum of users, which is a very difficult objective to achieve (Greenfield and Southgate 2003). However, attempt can be made to analyze the composite foods/ diets regionally, in order to contribute information to a database of a broader sense. It has been observed that information on cooked food of Indian dietaries is very limited and reported sporadically only from some regions (Nalwade et al. 2002; Singh et al.

2003; Das et al. 2005). Therefore, for calculating nutrient intake of a particular population or for formulating dietary guidelines for a population, one has to depend on nutritive value of raw foods, ignoring the effect of processing on various nutrient content (Premavalli et al. 2001; Rajyalakshmi et al. 2001).

Food habit and culinary practices are always region specific and typical of that region. Assam, a northeastern state of India has a typical food habit which is unique and distinct from the rest of the country. Although occupational migration is changing the dietary habit to some extent, traditional food habit still dominates the dietary pattern of Assamese people. Assamese dietaries include rice as a staple food and a composite diet consists of varieties of food components from different food groups. The traditional culinary practices of Assamese preparation are usually very simple and also preparations are less spicy. Some of the preparations of Assamese culinary have been documented elsewhere, but have not been analyzed for its nutrient composition. Hence, the present study was undertaken to evaluate some of the traditional preparations of Assam, with different green leafy vegetables, other vegetables, fish and meat. This was done in order to document the nutrient composition in terms of proximate compositions, calcium, iron, β carotene/retinol and vitamin C, of the selected traditional regional recipes of Assam.

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MATERIALS AND METHODS

Preparation and Standardization of Recipes

A total of 24 regional recipes of Assam were selected for the present study. Out of these, 7 preparations were from green leafy vegetables, 8 preparations were from other vegetables and 9 preparations were from fish and meat.

For standardization and preparations of the recipes, procedures already documented in recipe books of regional language and selected experienced persons were consulted. Raw samples were procured from market places depending upon the availability. Most of the indigenous green leafy vegetables were procured from the rural households.

General descriptions of the recipes are presented in Table 1. All the recipes are used as a accompaniment of the main dish, that is rice.

Sample Preparations

Prepared recipes were homogenized in a blender and subjected immediately for moisture, β -carotene, retinol and vitamin C analysis. The remaining samples were kept in deep fridge for other analysis.

Proximate Composition

The moisture, crude protein, fat, crude fibre and total mineral were determined by standard procedures of AOAC (1990). Carbohydrate content was calculated by difference and energy content by multiplying protein, fat and carbohydrate by factors 4, 9 and 4 respectively.

Micronutrient Composition

Iron and Calcium: For iron and calcium contents, ash solutions were prepared after dry ashing of the samples using standard methods (Raghuramulu et al. 1983). Iron was determined spectrophotometrically after developing the colour using potassium thiocyanate (Raghuramulu et al. 1983). Calcium content was determined by feeding the ash solutions to a digital flame photometer.

β -carotene, Retinol and Vitamin C: Homogenized samples were analyzed using standard methods for β -carotene (Nageswara Rao 1967), retinol (AOAC 1995) and vitamin C (Jagota and Dani 1982).

RESULTS AND DISCUSSION

Proximate Composition

The proximate composition of the recipes are given in the Table 2. A wide range of variation were observed in the nutrient content of the recipes. These were because of the difference in the types of food and the methods of preparations. The moisture content of the recipes varied from 29.3 ± 1.00 g/100g in *boriola mas bhoja* (R20) to 89.6 ± 0.12 g/100g in *mandhania chutney* (R3). Preparations from green leafy vegetables and other vegetables had relatively higher moisture content ranging from 64.8 ± 0.73 g/100g in *kalmou sak bhaji* (R4) to 89.6 ± 0.12 g/100g in *mandhania chutney* (R3). On the other hand, the moisture content of fish and meat based recipes ranged from as low as 29.3 ± 1.00 g/100g in *boriola mas bhoja* (R20) to as high as 81.9 ± 0.22 g/100g in *rou masar tenga* (R16).

The protein content varied from 0.7 ± 0.15 g/100g in *kasu thur patat diya* (R1) to 31.6 ± 0.13 g/100g in *kharikat diya murgi* (R24). As expected fish and meat based recipes had higher amounts of protein except *rou masar tenga* (R16) and *murgi mansar jol* (R21). Lower protein in these two particular preparations could be due to higher moisture content and inclusion of other vegetables in the preparations. Two fried fish preparations namely, *rou mas bhoja* (R17) and *boriola mas bhoja* (R20) had comparatively higher protein contents of 21.2 ± 0.20 g/100 g and 27.0 ± 0.73 g/100 g respectively and this is in accordance with the findings of Gokoglu et al. (2004) on fried fish.

The fat content of the recipes ranged from 0.6 ± 0.00 g/100 g in *mandhania chutney* (R3) to 26.7 ± 4.11 g/100 g in *boriola mas bhoja* (R20). Highest level of fat in this particular fried fish was because of high fat absorption by the small fish variety and also because of increase in dry matter (Gokoglu et al. 2004). Among the vegetable preparations, stir fried vegetable preparations had higher fat content than other chutney and mashed vegetable type of preparations.

The total mineral content was recorded lowest (1.2 ± 0.00 g/100 g) in *mandhania chutney* (R3) and highest (8.8 ± 1.11 g/100 g) in *boriola mas bhoja* (R20). The preparation of *boriola mas bhoja* (R20) was small fish deep fried as a whole and subjected for analysis with bones, since that is the usual consumable form. The higher amount of total

Table 1: General description of some regional recipes of Assam, India

<i>Local name of the recipes</i>	<i>Recipe code</i>	<i>Name of the recipes</i>	<i>Description of the recipes</i>
<i>Preparation from Green Leafy Vegetables</i>			
1) Kasu thur patat diya	R1	Chutney with young leaves and stalks of colocasia (<i>Colocasia antiquarum</i>)	Young leaves and stalks of colocasia, tomatoes, garlic and green chillies were tightly wrapped in banana leaves and cooked over a hot griddle. The content was mashed and seasoned with mustard oil and salt.
2) Masundari patat diya	R2	Chutney with masundari (<i>Houttuynia cordata</i>) leaves	Masundari leaves, garlic, fresh red chillies were tightly wrapped in banana leaves and cooked over a hot griddle. The content was mashed and seasoned with mustard oil and salt.
3) Mandhanian chutney	R3	Chutney with mandhanian (<i>Eryngium foetidum</i>)	Mandhanian leaves were ground to paste with garlic and green chillies. Seasoned with lemon juice, mustard oil and salt.
4) Kalmou sak bhaji	R4	Stir fried greens of kalmou (<i>Ipomoea aquatica</i>)	Chopped Kalmou leaves and diced potatoes were stir fried with seasonings.
5) Dhekia sak bhaji	R5	Stir fried greens of dhekia (<i>Diplazium esculentum</i>)	Chopped Dhekia leaves and diced potatoes were stir fried with seasonings.
6) Morisa sak bhaji	R6	Stir fried greens of amaranth (<i>Amaranthus hybridus</i>)	Chopped amaranth leaves and diced potatoes were stir fried with seasonings.
7) Lai sak bhaji	R7	Stir fried greens of lai (<i>Brassica campestris</i>)	Chopped green leaves of Lai were stir fried with seasonings.
<i>Preparations from Other Vegetables</i>			
8) Aloo pitika	R8	Boiled mashed potatoes (<i>Solanum tuberosum</i>)	Boiled potatoes were deskinning and mashed with seasonings of mustard oil and salt.
9) Pura aloo pitika	R9	Boiled mashed potatoes (<i>Solanum tuberosum</i>)	Potatoes roasted in traditional 'chula' of firewood, deskinning, mashed with seasoning of mustard oil and salt.
10) Aloo bilahi pitika	R10	Boiled mashed potatoes (<i>Solanum tuberosum</i>) and tomatoes (<i>Lycopersicon esculentum</i>)	Boiled potatoes were deskinning. Mashed with boiled tomatoes adding seasoning of mustard oil and salt.
11) Pura bengena aru sijua kani pitika	R11	Mashed roasted brinjal (<i>Solanum melongena</i>) and boiled egg	Brinjal was roasted over charcoal and deskinning. Egg boiled and shelled. Mashed together with seasoning of mustard oil and salt.
12) Kaldil bhaji	R12	Stir fried plantain flower (<i>Musa sapientum</i>)	Finely chopped plantain flower was stir fried with onion, spices and seasonings.
13) Kathalar tarkari	R13	Raw jackfruit (<i>Artocarpus heterophyllus</i>)	Deskinning and made pieces of raw jackfruit. Prepared curry with onion and spices.
14) Tita kerela bhaji	R14	Stir fried bittergourd (<i>Momordica charantia</i>)	Chopped bittergourd were stir fried with seasonings.
15) Bhat kerela bhaji	R15	Stir fried spine gourd (<i>Momordica dioica</i>)	Chopped spine gourds were stir fried with seasonings.
<i>Preparations from Fish and Meat</i>			
16) Rou masar tenga	R16	Rohu (<i>Labeo rohita</i>) fish curry with potatoes and tomatoes	Fish pieces marinated with salt and turmeric and deep-fried in mustard oil. Made thin curry with sliced potatoes and chopped tomatoes. Fried fish pieces added to the gravy, boiled for a while. Added lemon juice.

Table 1: Contd....

<i>Local name of the recipes</i>	<i>Recipe code</i>	<i>Name of the recipes</i>	<i>Description of the recipes</i>
17) Rou mas bhoja	R17	Fried rohu (Labeo rohita) fish	Fish pieces marinated with salt and turmeric and deep-fried.
18) Rou masar cutlet	R18	Rohu fish (Labeo rohita) cutlet	Prepared cutlets with boiled debonned fish, boiled potatoes, chopped onion, grated coconut, chopped coriander, chopped green chillies, lemon juice, salt and bread crumb. Shallow fried in oil.
19) Rou masar charchari	R19	Rohu (Labeo rohita) fish with mustard	Fish pieces were marinated with salt and turmeric and deep fried in mustard oil. Made gravy with mustard paste onions and green chillies. Fried fish pieces were added to the gravy and boiled for a few minutes.
20) Boriola mas bhoja	R20	Boriola fish (Aspideparia merar) fry	Cleaned small Boriola fishes were marinated with salt and turmeric and fried in mustard oil.
21) Murgi mansar jol	R21	Chicken curry	Chicken pieces fried with chopped onions, paste of ginger, garlic and spices added tomatoes and prepared gravy.
22) Bhoja murgi	R22	Fried chicken	Chicken pieces half cooked in salt and water. Marinated with ginger garlic paste. Coated with beaten egg seasoned with salt and pepper. Deep fried in oil.
23) Murgi mansar biryani*	R23	Chicken biryani	Chicken and basmati rice preparation with onions spices, cashew, raisins and saffron.
24) Kharikat diya murgi*	R24	Tandoori chicken	Chicken pieces marinated with ginger, garlic paste, ground spices, vinegar and salt. Cooked in a tandoor applying ghee.

* Not typically regional recipes, but included in the Assamese diet.

mineral could be due to the consieration of the whole fish.

The crude fibre content was considerably high (12.6 ± 0.04 g/100 g) in spine gourd preparations (*bhat kerela bhaji*, R15). Some of the other preparations out of vegetables also recorded considerable crude fibre contents. These were namely, *tita kerela bhaji* (R14), (6.5 ± 0.30 g/100g), *kasu thur patat diya* (R1) (5.2 ± 0.09 g/100g) and *kalmou sak bhaji* (R4) (5.4 ± 0.69 g/100g). One fish preparation namely *rou masar cutlet* (R18) had a higher amount of crude fibre recording 5.5 ± 0.04 g/100g, which could be due to the other ingredients like onions, coconut, coriander leaves and green chillies.

The carbohydrate content of the preparations varied from 4.3 ± 0.08 g/100g in *kasu thur patat diya* (R1) to 22.8 ± 0.02 g/100 g in *pura aloo pitika* (R9). A higher amount of carbohydrate and similar

to *pura aloo pitika* (R9) was also observed in *murgi mansar biryani* (R23). Both the preparations had carbohydrate based major ingredients, which had contributed towards the higher levels of carbohydrate.

Energy content of the recipes ranged from 34.4 ± 0.33 Kcal/100 g in *kasu thur patat diya* (R1) to 381.0 ± 24.00 Kcal/100 g in *boriola mas bhoja* (R20). All the preparations from fish and meat had higher amount of energy except *rou masar tenga* (R16), which was a preparation with high moisture content and comparatively low protein and fat content. Stir fried type of vegetable preparations also recorded comparatively higher energy values as compared to other vegetable preparations. This was because of relatively higher fat content of the stir fried preparations. Similar observations were also recorded in energy values expressed in Kilojoule.

Table 2: Proximate composition of some regional recipes of Assam, India (per 100 g as is basis)

S. No.	Name of the recipe	Recipe Code	Moisture (g)	Protein (g)	Fat (g)	Total mineral (g)	Crude fibre (g)	Carbohydrate (g)	Energy (kcal)	Energy (kJoule)
<i>Preparations from Green Leafy Vegetables</i>										
1.	Kasu thur patat diya	R1	86.4±0.00	0.7±0.15	1.6±0.00	1.8±0.05	5.2±0.09	4.3± 0.08	34.4± 0.33	143.9±1.38
2.	Masundari patat diya	R2	82.6±0.49	1.2±0.06	0.8±0.04	2.4±0.02	0.4±0.18	12.6± 0.04	62.4± 1.26	261.1±5.27
3.	Mandhania chutney	R3	89.6±0.12	1.7±0.09	0.6±0.00	1.2±0.00	0.6±0.06	6.3± 0.00	37.4± 0.75	156.5±3.14
4.	Kalmou sak bhaji	R4	64.8±0.73	1.2±0.03	11.8±0.19	3.0±0.17	5.4±0.69	13.8± 1.49	166.2± 7.19	695.4±30.08
5.	Dhekia sak bhaji	R5	73.8±0.36	1.7±0.02	7.8±0.02	1.4±0.63	4.6±0.01	10.7± 0.93	119.8± 1.63	501.2± 6.82
6.	Morisa sak bhaji	R6	69.0±0.48	1.6±0.05	12.9±0.28	3.4±0.08	3.2±0.05	9.9± 0.28	162.1± 0.16	678.2±0.67
7.	Lai sak bhaji	R7	76.8±0.19	1.6±0.00	5.5±0.01	5.1±0.09	2.0±0.08	9.0± 0.09	91.9± 0.91	384.5±3.80
<i>Preparations from Other Vegetables</i>										
8.	Aloo pitika	R8	79.6±0.00	3.3±0.21	1.3±0.00	1.3±0.11	0.5±0.01	14.0± 0.30	80.9± 0.06	338.5±0.25
9.	Pura aloo pitika	R9	70.5±0.16	3.0±0.18	1.3±0.03	2.1±0.14	0.3±0.01	22.8± 0.02	114.9± 1.19	480.7±4.98
10.	Aloo bilahi pitika	R10	82.8±0.21	3.5±0.07	0.8±0.08	1.7±0.00	0.3±0.01	10.9± 0.08	64.8± 1.17	271.1±4.89
11.	Pura bengena aru sijua kani pitika	R11	79.5±0.78	4.9±0.00	3.6±0.03	1.9±0.12	0.4±0.00	9.7± 0.06	90.8± 3.84	379.9±16.06
12.	Kaldil bhaji	R12	71.4±0.02	2.2±0.03	8.7±0.03	3.5±0.14	3.1±0.02	11.1± 0.09	131.5± 0.88	550.2± 3.61
13.	Kathalar tarkari	R13	73.5±0.13	1.3±0.05	8.1±0.05	2.0±0.62	2.9±0.24	12.2± 0.25	126.9± 4.79	530.9±20.04
14.	Tita kerela bhaji	R14	66.3±0.22	0.9±0.03	8.9±0.06	1.9±0.40	6.5±0.30	15.5± 0.71	145.7± 2.09	609.6±8.74
15.	Bhat kerela bhaji	R15	65.8±0.77	0.9±0.00	9.8±0.05	2.8±0.10	12.6±0.04	8.1± 0.85	124.2± 3.85	519.7±16.11
<i>Preparations from Fish and Meat</i>										
16.	Rou masar tenga	R16	81.9±0.02	2.0±0.01	2.7±0.04	1.7±0.00	0.2±0.23	11.5± 0.11	78.3± 0.14	327.6±0.58
17.	Rou mas bhoja	R17	56.8±0.00	21.2±0.20	11.6±0.11	3.4±1.70	0.1±0.37	6.9± 1.15	216.8± 4.70	907.1±19.66
18.	Rou masar cutlet	R18	47.9±0.72	8.3±0.11	22.5±1.27	3.2±0.52	5.5±0.04	12.6± 2.11	286.1± 6.63	1197.04±27.73
19.	Rou masar charchari	R19	60.1±0.33	8.9±1.20	13.8±3.40	2.7±0.44	1.2±0.72	13.3± 1.17	213.0±14.11	891.2±59.0
20.	Boriola mas bhoja	R20	29.3±1.00	27.0±0.73	26.7±4.11	8.8±1.11	ND	8.2± 1.14	381.0±24.00	1594.0±103.42
21.	Murgi masar jol	R21	64.6±0.78	4.1±0.20	13.8±2.37	2.7±0.02	1.8±0.03	13.0± 0.72	192.6±17.65	805.8±73.84
22.	Bhoja murgi	R22	44.1±0.64	26.9±0.37	16.3±5.30	1.9±0.11	0.6±0.00	10.2± 0.59	295.1± 3.20	1234.7±13.39
23.	Murgi masar biryani*	R23	59.8±0.72	8.8±1.94	6.9±2.30	1.4±0.32	1.0±0.03	22.1±12.20	185.7± 9.78	776.9±40.92
24.	Kharikat diya murgi*	R24	37.5±0.53	31.6±0.13	15.1±0.19	4.7±0.11	0.9±0.00	10.2± 0.34	303.1± 4.79	1268.2±20.04

Values are Mean ± SD ND = Not detectable

*Not typically regional recipes, but included in the Assamese diet.

Table 3: Micronutrient composition of some regional recipes of Assam, India (per 100 g as is basis)

S. No.	Name of the recipe	Recipe code	Calcium (mg)	iron (mg)	β -Carotene (mg)	Retinol (mg)	Vitamin C (mg)
<i>Preparations from Green Leafy Vegetables</i>							
1.	Kasu thur patat diya	R1	109.3 $\pm$ 4.54	2.6 $\pm$ 0.39	270.8 $\pm$ 12.74	-	24.1 $\pm$ 2.07
2.	Masundari patat diya	R2	192.8 $\pm$ 16.20	6.2 $\pm$ 0.29	1297.2 $\pm$ 393.28	-	6.3 $\pm$ 0.19
3.	Mandhanian chutney	R3	75.5 $\pm$ 4.33	2.2 $\pm$ 0.03	48.0 $\pm$ 9.78	-	6.1 $\pm$ 0.21
4.	Kalmou sak bhaji	R4	182.5 $\pm$ 5.50	3.4 $\pm$ 0.53	1403.0 $\pm$ 53.44	-	16.2 $\pm$ 0.11
5.	Dhekia sak bhaji	R5	73.5 $\pm$ 4.50	3.1 $\pm$ 0.22	313.9 $\pm$ 60.69	-	8.1 $\pm$ 0.62
6.	Morisa sak bhaji	R6	342.0 $\pm$ 14.0	7.8 $\pm$ 0.02	2278.0 $\pm$ 140.36	-	6.5 $\pm$ 0.02
7.	Lai sak bhaji	R7	358.7 $\pm$ 46.7	7.4 $\pm$ 0.44	103.4 $\pm$ 3.46	-	20.2 $\pm$ 0.31
<i>Preparations from Other Vegetables</i>							
8.	Aloo pitika	R8	52.0 $\pm$ 4.06	1.7 $\pm$ 0.25	7.9 $\pm$ 0.00	-	6.5 $\pm$ 0.54
9.	Pura aloo pitika	R9	107.2 $\pm$ 13.73	5.8 $\pm$ 0.11	9.1 $\pm$ 1.98	-	6.3 $\pm$ 2.25
10.	Aloo bilahi pitika	R10	153.5 $\pm$ 25.18	4.8 $\pm$ 0.87	16.0 $\pm$ 5.71	-	6.2 $\pm$ 0.05
11.	Pura bengana aru sijua kani pitika	R11	391.7 $\pm$ 2.37	3.7 $\pm$ 0.02	2.0 $\pm$ 0.07	189.00 $\pm$ 3.15	15.5 $\pm$ 0.15
12.	Kaldil bhaji	R12	102.0 $\pm$ 4.63	2.5 $\pm$ 0.05	9.8 $\pm$ 2.46	-	3.7 $\pm$ 0.02
13.	Kathalar tarkari	R13	128.9 $\pm$ 13.50	11.8 $\pm$ 0.32	ND	-	1.7 $\pm$ 0.04
14.	Tita kerela bhaji	R14	212.5 $\pm$ 14.5	4.6 $\pm$ 1.25	169.7 $\pm$ 92.24	-	8.2 $\pm$ 1.40
15.	Bhat kerela bhaji	R15	231.8 $\pm$ 45.40	4.8 $\pm$ 0.18	97.0 $\pm$ 20.58	-	9.1 $\pm$ 2.93
<i>Preparations from Fish and Meat</i>							
16.	Rou masar tenga	R16	122.8 $\pm$ 10.12	1.9 $\pm$ 0.05	19.6 $\pm$ 4.22	175.5 $\pm$ 56.00	41.5 $\pm$ 11.42
17.	Rou mas bhoja	R17	287.2 $\pm$ 42.77	5.1 $\pm$ 0.07	-	683.6 $\pm$ 72.00	12.2 $\pm$ 2.51
18.	Rou masar cutlet	R18	489.5 $\pm$ 19.59	3.7 $\pm$ 0.13	7.9 $\pm$ 0.79	440.9 $\pm$ 11.23	14.8 $\pm$ 15.11
19.	Rou masar charchari	R19	219.3 $\pm$ 11.45	3.9 $\pm$ 0.12	2.6 $\pm$ 0.04	214.2 $\pm$ 14.92	14.3 $\pm$ 3.40
20.	Boriola mas bhoja	R20	286.9 $\pm$ 17.22	7.9 $\pm$ 0.07	-	251.9 $\pm$ 42.55	15.4 $\pm$ 4.45
21.	Murgi mansar jol	R21	230.5 $\pm$ 20.33	2.0 $\pm$ 0.00	15.60 $\pm$ 1.32	143.3 $\pm$ 21.12	26.8 $\pm$ 3.32
22.	Bhoja murgi	R22	230.5 $\pm$ 11.27	6.5 $\pm$ 0.52	-	859.9 $\pm$ 10.72	9.4 $\pm$ 1.93
23.	Murgi mansar biryani*	R23	188.3 $\pm$ 15.23	5.1 $\pm$ 0.01	3.2 $\pm$ 0.09	740.3 $\pm$ 23.24	18.6 $\pm$ 4.11
24.	Kharikat diya murgi*	R24	678.5 $\pm$ 17.52	7.9 $\pm$ 0.22	-	235.2 $\pm$ 23.11	13.0 $\pm$ 2.43

Values are Mean $\pm$ SD, ND = Not detectable

* Not typically regional recipes, but included in the Assamese diet.

Micronutrient Composition

The micronutrient composition namely calcium, iron, β -carotene, retinol and vitamin C are presented in Table 3. It can be observed from the data that some of the green leafy vegetable preparations like *morisa sak bhaji* (R6) and *lai sak bhaji* (R7) had considerable amounts of calcium estimating 342.0 $\pm$ 14.0 mg/100 g and 358.7 $\pm$ 46.7 mg/100 g respectively. Some of the wheat based preparations, where amaranth leaves were incorporated as an ingredient, reported to have calcium level ranging from 114.84 to 177.73 mg/100g (Punia et al. 2004). Among the preparations of other vegetables, *pura bengana aru sijua kani pitika* (R11) had higher calcium content recording 391.7 $\pm$ 2.37 mg/100g, which could be due to incorporation of egg in the recipe. Most of the preparations from fish and meat had higher calcium content and highest recorded value was observed in *kharikat diya murgi*, R24(678.5 $\pm$ 17.52 mg/100g).

Iron content of the recipes ranged from 1.7 $\pm$ 0.25 mg/100g in *aloo pitika* (R8) to 11.8 $\pm$ 0.32 mg/100g in *kathalar tarkari* (R13). Comparatively

higher amounts of iron were also recorded (7.4 $\pm$ 0.44 to 7.9 $\pm$ 0.22 mg/100g) in preparations like *lai sak bhaji* (R7), *morisa sak bhaji* (R6), *boriolas mas bhoja* (R20) and *kharikat diya murgi* (R24). A range of iron contents, lower as well as higher, than the values of the present study from similar greens of the present study were also reported by several earlier workers (Arora 2000; Nalwade et al. 2002; Hels et al. 2004; Sheela et al. 2004). Such variations could be possible due to the differences in variety of greens used in present study and the earlier reported studies and also due to the inclusion of different types of ingredients. However, the data generated from the present study indicated that except a few recipes, most of them were good sources of iron.

β -carotene content of the vegetable based recipes and recipes with fish and meat where vegetables were also included ranged from 2.0 $\pm$ 0.07 μ g/100g in *pura bengana aru sijua kani pitika* (R11) to 2278.0 $\pm$ 140.36 μ g/100g in *morisa sak bhaji* (R6). A much higher β -carotene content (5860 μ g/100g) of bolied amaranthus species was reported by Rajylakshmi et al.(2001). The reason for comparatively lower β -carotene in stir fried

amaranth of the present study could be due to difference of amaranth used and difference in cooking methods. Considerable amounts of β -carotene were also observed in *masundari patat diya*, R2, ($1297.2 \pm 393.28 \mu\text{g}/100\text{g}$) and *kalmou sak bhaji*, R4, ($1403.0 \pm 53.44 \mu\text{g}/100\text{g}$).

Lowest retinol levels of the recipes was recorded in *murgi mansar jol*, (R21) ($143.3 \pm 21.12 \mu\text{g}/100\text{g}$), whereas the highest level was recorded in *bhoja murgi*, R22, ($859.9 \pm 10.72 \mu\text{g}/100\text{g}$).

As in case of other nutrients, vitamin C content of the recipes also indicated a range from $1.7 \pm 0.04 \text{ mg}/100 \text{ g}$ in *kathalar tarkari* (R13) to $41.5 \pm 11.42 \text{ mg}/100 \text{ g}$ in *rou masar tenga* (R16)

It was observed that there were wide variations in the nutrient content of the recipes in all cases. This could be predicted that since there were variations in the type of preparations and use of ingredients, such variations in nutrient content are possible.

CONCLUSION

The study indicated that nutrient composition of some of the regional recipes of Assam are promising. Since the preparations are based on the usually consumed form, the data will serve as a basis for calculating nutrient intake of Assamese population. However, the study was only an initial approach in developing nutrient database of regional Assamese recipes. Assamese dietaries includes hundreds of recipes with some variations as per different regions of Assam. Therefore, for a complete database, a more extensive research work to be carried out in this directions which has further applications in various health and nutritional issues.

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