NUTRIENT COMPOSITION AND RETENTION OF SELECTED TRADITIONAL BANGLADESHI CURRIES AND FESTIVAL DISHES

Bioresearch Communications
Volume 12, Issue 1, January 2026

DOI: doi.org/10.3329/brc.v12i1.86760

Anamika Mondol and Abu Torab MA Rahim*

Institute of Nutrition and Food Science (INFS), University of Dhaka, Dhaka-1000, Bangladesh

ABSTRACT

Background and Objectives: The near absence of nutrient profiles for cooked recipes in local food composition databases limits their application in dietary planning, nutritional assessment, and public health analytics. Chemical analysis of standardized recipes commonly prepared in households can help address this gap. This study quantified the proximate composition of selected homemade curries and festival dishes consumed in urban and peri-urban areas of Bangladesh. **Methodology:** A cross-sectional ingredient survey was conducted among 150 purposively selected housewives from Dhaka and Tangail districts to collect recipe profiles. Seven standardized recipes (four vegetable-based dishes and three festival dishes) were prepared following traditional cooking practices and analysed for proximate nutrient composition using standard operating procedures (SOPs) based on Association of Official Analytical Chemists (AOAC) methods. Precision and accuracy were ensured through a Quality Assurance Program. Cooking yield (YF) and nutrient retention factors (NRF) were calculated. Unanalysed micronutrients were compiled from national, regional, and global food composition databases using the FAO/INFOODS toolkit. **Results:** Nutrient contents (g/100 g) ranged as follows: moisture 60.09–78.73%, protein 2.92–10.89%, fat 2.48–22.28%, available carbohydrate 1.8–24.25%, total dietary fibre 0.34–7.94%, and ash 0.42–4.08%. YF ranged from 49.24% in jute leaves fry to 90.38% in motar polao. NRF exceeded 100% for several nutrients, with peaks for protein in chicken roast (126.90%), fat in lentil-tomato daal (105.92%), total dietary fibre in motar polao (105.92%), and available carbohydrate in bottle gourd leaves fry (218.34%). Moisture and ash retention were highest in motar polao (83.40% and 126.53%), indicating minimal mineral loss during cooking (98.41–126.53%). Analysed and compiled data were consistent with reported values, confirming dataset quality. **Conclusion:** This study provides one of the first validated datasets of cooked Bangladeshi dishes, offering high-quality "as-consumed" nutrient values. The findings represent a significant contribution to the national food composition database and hold strong relevance for dietary assessment, nutrition research, and public health policy in Bangladesh.

KEYWORDS: Home-cooked dishes, Standardized recipes, Proximate composition, Nutrient retention, Food composition database

RECEIVED: 20 October 2025, ACCEPTED: 06 December 2025

TYPE: Original Article

***CORRESPONDING AUTHOR: Dr. Abu Torab MA Rahim, Institute of Nutrition and Food Science, University of Dhaka, Dhaka-1000, Bangladesh Email: torabrahim@du.ac.bd**

Introduction

Reliable and unerring food composition data are critical for dietary planning, nutrition research, and public health interventions (Greenfield & FAO 1993). However, the food composition tables (FCTs) currently available in Bangladesh emphasize raw ingredients analysis and contain limited information on cooked or mixed dishes (HKI & WFP 1988; INFS 1992; Shaheen et al. 2013). Data limitation on cooked recipes is a major obstacle to diet calculation of home-prepared, multi-ingredient foods. Calculating nutrients from raw ingredient values often produces inaccuracy, as cooking alters the nutrient profile through moisture loss, oil absorption, denaturation, and leaching of vitamins and minerals. Without data on cooked dishes, assessments of actual dietary intake and diet–disease relationships remain incomplete (Ferrari et al. 2008; Deng et al. 2017).

For over two decades, our laboratory has worked on the analysis of Bangladeshi home-prepared foods, developing protocols for recipe surveys, standardization methodologies, and harmonized standard operating protocol (SOP) for laboratory nutrient analysis. Previous works from our laboratory have generated premier datasets on snack foods and pickles. However, comprehensive data on frequently consumed vegetable curries and festival dishes are still lacking. To address this gap, the present study employed a semi-analytical approach, defined as a combination of direct chemical analysis (for proximate nutrients) and systematic data compilation (for micronutrients). Seven selected and standardized recipes (four curries and three festival dishes) were profiled using ingredient data collected from 150 households in Dhaka and Tangail. Both ingredients and cooking procedures were standardized using an SOP reported earlier (Bithi 2005; Mahbuba 2018; Afrin, Akter & Rahim 2024) to get standardized recipes for preparation. Their proximate composition was analysed in our laboratory following AOAC (AOAC 2000) standard methods, while cooking yield and nutrient retention factors were also determined. Micronutrient values not analysed chemically were compiled from established food composition databases using the FAO/INFOODS toolkit (INFOODS 2017).

By generating laboratory-based precise nutrient values for these recipes, the current study provides one of the first detailed datasets on cooked Bangladeshi dishes. The results are expected to strengthen the national food composition database, improve dietary assessment accuracy, and support evidence-based nutritional policies tailored to the Bangladeshi population.

Materials and Methods

Survey of Recipe Ingredient Collection

An ingredient survey was conducted among 150 specifically chosen housewives from households in Dhaka (n = 75) and Tangail cities (n = 75) to gather a list of ingredients commonly used for preparing the selected recipes for family meals. The survey was conducted using a pretested survey questionnaire by interviewing the participants face-to-faces on the basis of their oral consents, which was established in our laboratory by several studies (Ara 2003; Arjoo 2005; Mustary 2009; Mahbuba 2018; Afrin et al. 2024; Mili & Rahim 2024). Information on the seasonality, availability, and preparation frequency of foods consumed was collected to develop a key recipe list. Additional relevant details regarding recipe preparation were gathered, and a similar recipe from a cookbook (Kabir 2010) was used to compare with the recipe preparation procedures gathered from the survey.

Recipe Selection and Standardization

The standardized recipe protocol has been developed, refined, and routinely applied in our laboratory for over two decades (Ara 2003; Arjoo 2005; Mustary 2009; Mahbuba 2018; Afrin et al. 2024; Mili & Rahim 2024). A brief outline of the key steps is presented in the following scheme:

Initially, the name, quantity, size, and volume of each ingredient in every recipe were recorded.

↓

To ensure consistency, the quantities of ingredients listed in the recipes (such as piece, tablespoons, cup) were measured in grams using a scale.

↓

Each ingredient mentioned in the recipes was totalled to calculate its citation percentage.

↓

The mode of citing an ingredient across similar recipes was utilized to compile the list of ingredients for a standardized recipe.

↓

Ingredients for a specific recipe were selected based on the most commonly used amount in the recipe, considering availability and cost-effectiveness.

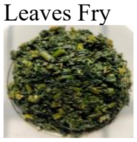
↓

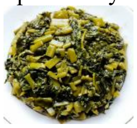
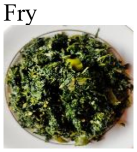
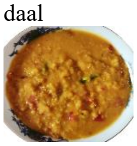
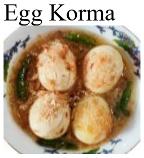
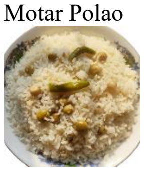
Recipes were cooked at mode serving number amount as described by the respondents.

Preparation of Standardized Curry and Festival Dishes for Laboratory Analysis

Ingredients for the selected standardized recipes were sourced from local markets and used promptly for preparation. The cooking method was also standardized from the customary cooking procedures narrated by each survey participants. Recipe weights were recorded before and after cooking to calculate cooking yield factors, following the method by (Bognár 1998). After preparation, samples were blended immediately, with portions of cooled samples analysed for moisture content (Raghuramulu, Nair & Kalyanasundaram 2003). The remaining samples were oven-dried at 65° ± 5°C for 12-14 hours (Begum 2004), then powdered, poured in small Ziplock sachets and stored in desiccators until further analysis.

Table 1. Ingredients and Their Amounts for Selected Recipes

Food Items	Ingredients (g) and Preparation Procedure (PP)	Total Raw Weight (g)
Bottle Gourd Leaves Fry 	Bottle Gourd Leaves (483), Salt (4.7), Green Chilli (10.5), Soybean Oil (26.7), Garlic (4.8), Onion (21.1) PP: The bottle gourd leaves were cleaned and chopped. Oil was heated in a pan, and onions were sautéed until brown. Garlic, salt, and green chilies were added, followed by the chopped leaves. After stirring for 1-2 minutes, the mixture was cooked with the lid on for 5-6 minutes, stirring occasionally, until all the water evaporated.	550.8

Indian Spinach Fry 	Indian Spinach, green (788), Salt (3.5), Soybean Oil (30), Green Chilli (10.2), Onion (21.2), Garlic (4.8) PP: The leaves and stems of Indian spinach were cleaned and chopped. A pan was preheated on medium-low flame, then oil was added. Once warm, onions were added and browned. Garlic, salt, and green chilies were mixed in, followed by the chopped spinach. After stirring for 1-2 minutes, the pan was covered and cooked for 5-6 minutes. The lid was removed, and the vegetables were stirred continuously until all the water evaporated.	857.7
Jute Leaves Fry 	Jute Leaves, sweet variety (145), Salt (3.5), Soybean Oil (20), Green Chilli (10.7), Onion (10.8), Garlic (2.6), Water (110) PP: The jute leaves were cleaned and chopped. A pan was preheated on medium-low heat, then oil was added. Once warm, onions were browned, then garlic, salt, and green chilies were mixed in. The chopped jute leaves were stirred for 1-2 minutes. Water was added, and the pan was covered and cooked for 5-6 minutes. The lid was removed, the vegetables were stirred, and the lid was replaced, repeating until the water evaporated.	302.6
Lentil-Tomato daal 	Lentil (250), Tomato, red, ripe (200), Turmeric Powder (1.5), Salt (14), Water (1430), Green Chilli (18.7), Soybean Oil (75), Onion (88.7), Garlic (4.7) PP: The lentils were cleaned, boiled in salted water for 20-25 minutes, then simmered with turmeric and tomato for 5-6 minutes. Separately, onions were browned in heated oil, then garlic, boiled lentils, and their water were added. Green chilies were mixed in, and the dish was covered to cook on medium-low for 5-6 minutes. After adjusting seasoning and stirring, the lentils were served at the desired consistency.	2082.6
Chicken Roast 	Chicken, Pakistani cock, boneless (350), Salt (10.5), Garlic (4.7), Onion (104), Soybean Oil (120), Ginger (4), Sour Yogurt (125), Green Chilli (13.2), Water (440), Cinnamon (0.8), Cardamon (0.4), Bay leaves (0.8), Garam Masala, crushed cinnamon and cardamon into 2:1 (g/g) ratio (1.5), Peanut (13.9), Ghee, from cow (7.5), Sugar, white (2.5) PP: The chicken was marinated with salt for 10-15 minutes, fried until browned, and set aside. In the same pan, spices (cinnamon, cardamom, bay leaf) were briefly fried, then onions until golden. Garlic, ginger, peanut, green chili paste, and salt were added and mixed well, followed by sour yogurt and water. The chicken was returned, covered, and cooked for about 20 minutes. Green chilies, garam masala, and ghee were added before finishing to the desired consistency.	1200.4
Egg Korma 	Egg, chicken, farmed (230), Salt (3.5), Onion (52.9), Soybean Oil (30), Green Chilli (7.8), Garlic (2.3), Ginger (2), Water (110), Sour Yogurt (62.5), Cardamon (0.4), Cinnamon (0.8) PP: Eggs were boiled for 7-8 minutes, peeled, scratched for spice absorption, and seasoned with salt. In a pan, oil was heated, and eggs were fried for 2 minutes, then set aside. Cinnamon, cardamom, and onion slices were sautéed until golden, followed by garlic, ginger paste, and salt. Sour yogurt and water were added and sautéed. The eggs were returned, covered, and cooked for 4-5 minutes. Green chilies were added, and after 2-3 more minutes, the dish was stirred until fully cooked.	502.2
Motar Polao 	Rice, white, aromatic, Chinigura, sunned, (500g), Motar (100g), Salt (3.5g), Water (1100g), Soybean Oil (37.5g), Cinnamon (0.8g), Cardamon (0.4g), Bay Leaves (0.4g), Green Chilli (7.8g), Ginger Paste (3g), Onion (42.4g), Ghee (5g), Garlic (4.9g) PP: Rice was washed and soaked for 30 minutes. In a heated pan with oil and ghee, spices (cinnamon, cardamom, bay leaves) were sautéed briefly. Onions were fried until golden, then garlic and ginger pastes were added. The soaked rice was stirred in for 10 minutes, followed by water, peas, and green chilies, then covered until fully cooked.	1805.7

Proximate Analysis

Homogenized dried samples in zip lock packets were taken out from desiccators for proximate analysis. Except moisture, all estimations followed the Official Methods of Analysis (OMA) by (AOAC 2000) were applied and depicted in Table 2. Each sample underwent analysis in triplicate for each parameter, ensuring robust estimations.

Table 2. Variable-Indicator-Method Matrix for Laboratory Analysis

Variable	Indicator	Method	Reference
	Moisture	Gravimetric Analysis by Heating	ICMR 2003, AOAC 2000
	Ash	Gravimetric Analysis by Ashing	AOAC 2000
	Crude Protein	Micro-Kjeldahl Method	AOAC method 992.23
Proximate Analysis	Crude Fat	Soxhlet Method	AOAC method 966.01

	Total Dietary Fiber	Modified Prosky Method	AOAC method 985.29
	Available Carbohydrate	By Calculation Available CHO (g/100g) = 100 – (protein + lipid + moisture + ash + TDF)	(Rand 1991)
Food Energy	Total Calorie	By Calculation Total energy (kcal/100g) = (Protein × 4 + Fat × 9 + Carbohydrate × 4 + TDF × 2)	(Atwater & Bryant 1900)

Determination of Cooking Yield
The cooking yield was determined after Bognar (Bognár 1998). It offers insights into weight changes occurring during food preparation, such as water absorption in rice during cooking or water loss during meat preparation (McCarthy 1992) .

$$\text{Cooking yield (\%)} = \frac{\text{Weight of food after cooking (g)}}{\text{Weight of food before cooking (g)}} \times 100$$

Determination of Nutrient Retention Factors
Nutrient retention refers to the proportion of a nutrient that remains in the food after cooking, relative to the amount present in a known weight of the raw food (Murphy et al., 1975).

$$\text{Nutrient retention (\%)} = \frac{\text{Nutrient content per g of cooked food}}{\text{Nutrient content per g of raw food}} \times \text{Cooking yield (\%)}$$

Compilation of Vitamin and Mineral Values
Vitamin and mineral contents were compiled from various local (FCT 2013), regional (IFCT 2017), and global datasets (CoFID 2021) . This was performed by creating an archival, reference, and user datafile respectively using the FAO/INFOODS Data Compilation Tool version 1.2.1 (INFOODS 2017). The final calculated nutrient values were adjusted for water and fat corrections and arranged according to their tagnames.

Quality Assurance Program (QAP)
For each analytical method, the coefficient of variation (CV) was quantitatively assessed as an index of precision. Instead of using commercial reference materials, an In-House Reference Material (IHRM) was employed to verify the accuracy of the nutrient values (Greenfield & Southgate 2003) of the analysed foods by co-analysing a portion of the IHRM in each analysis batch.

$$\%\text{CV} = \frac{\text{SD}}{\text{Mean}} \times 100$$

The relative error was calculated as an indicator of accuracy. The formulas of absolute error and relative error are (Nielsen 1994): Absolute error = (Experimentally determined value – True value);

$$\%\text{ Relative error} = \frac{\text{Absolute error}}{\text{True value}} \times 100$$

Results

Socio-Demographic Features of the Survey Respondents
Table 3 presents the sociodemographic details of the respondents of recipe survey after data cleaning. Most participants were homemakers (68.7%) and over 40 years of age (46.6%). Nearly 94% of the respondents had formal education.

Table 3. Sociodemographic Features of the Survey Respondents

Characteristics	Frequency (n = 150)	Percentage (%)
Age (Years)		
<25	19	12.7
25-40	61	40.7
>40	70	**46.6**
Education		
No-Formal Education	9	6.0
Primary Education	21	14.0
Up to HSC	63	**42.0**
Graduate and above	57	38.0
Profession		
Non-working Housemakers	103	**68.7**
Working	31	20.6
Student	16	10.7
Family Monthly Income (Tk)		
<20000	29	19.3
20000-80000	90	**60.0**
>80000	31	20.7

Ingredient Survey Results and Recipe Profile

Table 4 displays the citation percentage of 10 selected recipes by the respondents based on minimum acceptable citation percentages thereby indicating food preparation preferences.

Table 4. Percentage of Recipe Citations by Recipe Type

Recipes	Recipe citated by HH (no.)	*Citation %
Curry Dishes		
Bottle Gourd Leaves Fry	144	13.64
Indian Spinach Fry	143	13.54
Jute Leaves Fry	142	13.45
Lentil-Tomato daal	118	11.17
Radish Leaves Fry	114	10.8
Festival Dishes		
Chicken Roast	116	10.98
Motar Polao	101	9.56
Egg Korma	98	9.28
Mutton Rezala	46	4.36
Rohu Fish Kofta	34	3.22
Total	1056	100

*Calculated from total citation of all recipes

Recipe Standardization Procedure

From the list of recipes, three festival dishes and four curry dishes were chosen for standardization in analysis (narrated in section 2.2). These were selected based on their popularity among respondents and ingredient availability as indicated by market observations. These recipes include bottle gourd leaves fry, Indian spinach fry, jute leaves fry, lentil-tomato daal, chicken roast, motar polao and egg korma.

Proximate Nutrient Analysis

Analyses were conducted on a dry weight basis, with final results adjusted to reflect water content per 100 g of each sample, simulating fresh weight. Table 5 presents the proximate composition and energy values of the recipe samples. The moisture content ranged from 67.82% to 78.43% (g/100 g of cooked sample) in curry dishes. Festival dishes had relatively lower moisture content (60.09% to 71.32%). Ash content varied from 0.42% to 4.08%. Protein content ranged from 2.92% to 10.89%, and fat content varied significantly (2.48% to 22.28%) due to the different amounts of oil used in cooking. Available carbohydrate content ranged from 1.8% to 9.42%, except for motar polao, which had 24.25%. Total dietary fibre (TDF) content ranged from 0.34% to 7.94%, with higher values for curry dishes (2.62% to 7.94%). The energy content of 100 g of the cooked recipes ranged from 101.72 to 259.6 kcal.

Table 5. Energy Content and Proximate Composition of Standardized Recipes Before and After Cooking (g/100 g edible portion) ¶ ®

Food Items		Energy (kcal)	Moisture	Protein	Fat	Available CHO#	TDF	Ash
Bottle Gourd Leaves Fry	**Before Cook**	74	85.0±0.07	2.9±0.03	5.6±0.08	1	3.8±0.04	1.8±0.01
	After Cook	124	73.5±0.49	4.7±0.04	8.7±0.08	3.3	6.9±0.04	3.0±0.02
Indian Spinach Fry	**Before Cook**	59	88.3±0.04	2.1±0.02	4.4±0.01	1.6	2.1±0.05	1.5±0.005
	After Cook	102	78.4±0.17	3.3±0.02	6.8±0.04	5	3.8±0.01	2.8±0.03
Jute Leaves Fry	**Before Cook**	78	84.8±0.07	2.7±0.01	6.4±0.04	0.8	3.5±0.02	1.9±0.02
	After Cook	161	67.8±0.66	5.4±0.03	12.9±0.09	1.8	7.9±0.05	4.1±0.05
Lentil-Tomato daal	**Before Cook**	76	83.6±0.25	3.6±0.02	3.7±0.04	6.1	1.9±0.02	1.1±0.003
	After Cook	127	73.1±0.52	6.8±0.05	6.3±0.02	9.4	2.6±0.07	1.7±0.02
Chicken Roast	**Before Cook**	160	76.4±0.15	4.7±0.05	14.3±0.09	2.9	0.4±0.01	1.3±0.003
	After Cook	260	60.1±0.42	10.9±0.10	22.3±0.11	3.6	0.5±0.02	2.6±0.11

Egg Korma	**Before Cook**	118	79.8±0.27	7.5±0.01	8.7±0.03	2.5	0.3±0.01	1.2±0.006
	After Cook	169	71.3±0.07	10.0±0.05	12.5±0.15	4	0.3±0.004	1.9±0.02
Motar Polao	**Before Cook**	115	73.3±0.23	3.6±0.03	2.5±0.01	18.9	1.4±0.02	0.3±0.002
	After Cook	136	67.6±0.42	2.9±0.06	2.5±0.03	24.3	2.3±0.08	0.4±0.02

¶ The results are expressed as mean of triplicate estimations ± SD
® Each 'Before Cook' sample contains the same ingredients in the same quantities as the corresponding 'After Cook' sample
Available Carbohydrates and energy are calculated from the mean value of each sample

Determination of Cooking Yield and Nutrient Retention Factors

Among the studied Multi-Ingredient Foods (MIFs), moisture retention factors were reduced across all dishes, ranging from 39.40% to 83.40%. Ash retention factors were relatively high, ranging from 98.41% to 126.53%. Among the studied dishes, motar Polao showed the highest retention factors, with moisture at 83.40%, ash at 126.53%, and total dietary fibre remarkably high at 148.07%. The protein retention factor was highest for chicken roast (126.90%) and lowest for motar polao (73.31%). lentil-tomato daal showed the highest retention factor for fat (105.92%). Bottle gourd leaves Fry retained highest amount of carbohydrate (218.34%).

Table 6. Percentages of Cooking Yield and Nutrient Retention of Key Nutrients after cooking

Food Items	**Cooking Yield (%)**	**Nutrient Retention Factor (%)**					
		Moisture	**Protein**	**Fat**	**Available CHO#**	**TDF***	**Ash**
Bottle Gourd Leaves Fry	64.45	55.75	102.72	100.06	218.34	117.90	107.18
Indian Spinach Fry	63.88	56.77	99.95	97.83	195.17	115.48	117.54
Jute Leaves Fry	49.24	39.40	97.94	99.95	116.62	113.00	104.09
Lentil-Tomato daal	61.94	54.18	116.20	105.92	96.28	83.65	98.41
Chicken Roast	54.65	42.97	126.90	85.27	68.17	67.66	106.80
Egg Korma	73.68	65.82	98.27	105.80	117.42	86.38	116.21
Motar Polao	90.38	83.40	73.31	89.66	115.90	148.07	126.53

Available Carbohydrate, *Total Dietary Fiber

Data quality status by Quality Assurance Program (QAP)

Precision: Table 7 presents the CV of different nutrient analyses in cooked samples. CV value for ash (1.60%) showed highest variations in analysis repeats. It is, however, far low variation than the acceptable cutoff of ≤ 5%.

Table 7. Precision Level of the Proximate Analysis

Nutrients	**Mean (g/100g of sample)**	**Standard Deviation**	**Coefficient of Variation (%)**
Moisture (fresh)	75.95	0.27	0.36
Ash (fresh)	1.88	0.03	**1.60**
Protein (dried)	19.78	0.14	0.71
Fat (dried)	32.81	0.23	0.69
Dietary Fiber (dried)	16.12	0.21	1.30

Accuracy: The proximate composition estimates for IHRM (Ruti) from the previous analysis (12 months prior) and the current analysis are shown in Table 8. The relative error was highest for ash, with a relative error of less than 5%.

Table 8. Difference in Estimations of IHRM Between Previous (2023) and Current (2024) Proximate Analyses

Nutrients	Estimations (g/100g EP)		Error in Estimates	
	Pervious Estimation (E1)	Current Estimation (E2)	Absolute Error	Relative Error (%)
Moisture	3.694	3.773	0.079	2.1397
Ash	0.5993	0.5859	-0.0134	**-2.2358**
Protein	12.692	12.747	0.055	0.4336
Fat	5.716	5.7502	0.0342	0.5983
Dietary Fiber	3.007	2.9964	-0.0106	-0.3527

Compilation of Vitamins and Minerals

Since vitamin and mineral contents of the studied recipes were not analysed, their respective values were compiled from secondary databases (outlined in section 2.7). Tables 9 and 10 summarize the vitamin and mineral profiles of the cooked dishes. Leafy vegetables like bottle gourd leaves fry, Indian spinach fry, and jute leaves fry were found rich in vitamin A (294 - 6920 mcg), beta-carotene (3539 - 83041mcg), and vitamin C (17 - 109 mg). Notably, jute leaves fry also contained a very high level of vitamin E (35.8 mg). Among animal-based dishes, egg korma showed the highest vitamin D (1.3 mcg) and notable vitamin E (1.29 mg), while motar polao also provides significant vitamin E (1.37 mg) and chicken roast is a good source of niacin (6.0 mg).

In terms of minerals, leafy dishes, particularly Indian spinach fry and jute leaves fry, were high in calcium (109 - 331 mg), with jute leaves fry being the richest in iron (7.15 mg), zinc (1.30 mg), and phosphorus (125 mg), while bottle gourd leaves fry contained the highest potassium (276 mg). Among animal-based dishes, chicken roast shows the highest zinc (1.83 mg), whereas egg korma contained moderate levels of several minerals. Motar polao, although comparatively lower in mineral content, still contributed small amounts of calcium, phosphorus, and potassium.

Table 9. Vitamin Contents of the Cooked Recipes (in 100g)

Food Items	Vit A (mcg)	Beta-carotene equivalents (mcg)	Vit D (mcg)	Vit E (mg)	Vit B1 (mg)	Vit B2 (mg)	Niacin equivalents (mg)	Vit B6 (mg)	Folate (mcg)	Vit C (mg)
Bottle Gourd Leaves Fry	294	3539	0.0	2.32	0.07	0.17	1.4	0.18	27	17.6
Indian Spinach Fry	3400	40800	0.0	0.00	0.02	0.31	0.4	0.21	92	27.3
Jute Leaves Fry	6920	83041	0.0	35.8	0.26	0.07	2.2	0.38	111	109.1
Lentil-Tomato daal	4	53	0.0	12.37	0.09	0.04	1.2	0.12	5	1.2
Chicken Roast	87	0	0.9	3.20	0.11	0.21	6.0	0.43	15	0.0
Egg Korma	166	255	1.3	1.29	0.11	0.02	2.2	0.17	17	2.4
Motar Polao	1	17	0.0	1.37	0.10	0.02	1.0	0.09	8	0.1

Table 10. Mineral Contents of the Cooked Recipes (in 100g)

Food Items	Ca (mg)	Fe (mg)	Mg (mg)	P (mg)	K (mg)	Na (mg)	Zn (mg)	Cu (mg)
Bottle Gourd Leaves Fry	94	3.10	69	28	276	41	0.49	0.15
Indian Spinach Fry	109	1.20	142	52	123	69	0.43	0.08
Jute Leaves Fry	331	7.15	42	125	225	60	1.30	0.07
Lentil-Tomato daal	15	1.64	17	61	162	13	0.60	0.11
Chicken Roast	16	0.90	25	210	295	170	1.83	0.06
Egg Korma	39	1.18	14	85	190	130	0.60	0.07
Motar Polao	16	0.64	10	36	88	170	0.40	0.09

Differences in Compiled and Recipe-Calculated Nutrient Values

Nutrient values obtained from compiled sources and recipe-calculated estimates differed considerably (Tables 11 and 12). Here, positive values indicate higher compiled values and negative values indicate higher recipe-calculated values.

Across vitamins, very large positive percentage differences were observed for vitamin E in several dishes, particularly jute leaves fry (7855.56%) and lentil-tomato daal (4848.00%). Vitamin A and beta-carotene equivalents also showed high positive differences in leafy vegetable dishes, including jute leaves fry (2398.04% and 2400.02%) and Indian spinach fry (1398.46% and 1401.37%). Negative differences were common for vitamin D (−100% in most dishes) and vitamin C across multiple items, such as bottle gourd leaves fry (−68.67%) and motar polao (−80.70%).

For minerals, calcium displayed notable positive differences, including jute leaves fry (175.37%) and motar polao (104.87%). In contrast, sodium exhibited consistently large negative differences in most dishes, reaching −92.90% in bottle gourd leaves fry and −97.01% in lentil-tomato daal. Negative differences were also evident for copper and zinc in several dishes, such as copper (−72.00%) and zinc in egg korma (−62.96%). The percentage differences varied widely across nutrients and dishes, with some values exceeding several thousand percent.

Table 11. Percentage Difference Between Compiled and Recipe-Calculated Vitamin Values of Cooked Recipes

Food Items	Vit A (mcg)	Beta-carotene equivalents (mcg)	Vit D (mcg)	Vit E (mg)	Vit B1 (mg)	Vit B2 (mg)	Niacin equivalents (mg)	Vit B6 (mg)	Folate (mcg)	Vit C (mg)
Bottle Gourd Leaves Fry	17.82	17.85	-100.00	828.00	-22.22	-26.09	-28.57	-30.77	-61.89	-68.67
Indian Spinach Fry	1398.46	1401.37	-100.00	-100.00	-33.33	-38.00	-45.95	-36.36	-35.02	-56.66
Jute Leaves Fry	2398.04	2400.02	-100.00	7855.56	188.89	-86.54	37.27	-33.33	30.11	117.73
Lentil-Tomato daal	74.02	77.44	-100.00	4848.00	-18.18	0.00	48.72	71.43	-18.74	-67.60
Chicken Roast	532.87	-100.00	77.55	350.70	83.33	-8.33	17.91	152.94	87.30	-100.00
Egg Korma	69.15	2802.16	-33.51	61.25	0.00	-19.23	-1.80	41.67	-41.67	-6.56
Motar Polao	11.02	306.70	-100.00	705.88	233.33	0.00	31.65	800.00	150.75	-80.70

% Difference = [(Compiled values − Recipe-Calculated values) / Recipe-Calculated values] × 100

Table 12. Percentage Difference Between Compiled and Recipe-Calculated Mineral Values of Cooked Recipes

Food Items	Ca (mg)	Fe (mg)	Mg (mg)	P (mg)	K (mg)	Na (mg)	Zn (mg)	Cu (mg)
Bottle Gourd Leaves Fry	-27.80	-29.06	-28.51	-35.63	-30.25	-92.90	-35.53	-40.00
Indian Spinach Fry	-32.47	-63.08	-45.25	9.08	-56.26	-80.38	-24.56	-33.33
Jute Leaves Fry	175.37	-25.98	-8.70	89.52	-12.93	-93.90	-19.75	-36.36
Lentil-Tomato daal	88.68	62.38	9.32	18.45	17.81	-97.01	-21.05	-60.71
Chicken Roast	-70.08	32.35	-5.37	70.12	38.21	-74.64	36.57	-57.14
Egg Korma	-29.39	5.36	-31.17	-48.52	23.31	-71.59	-62.96	-72.00
Motar Polao	104.87	16.36	-48.69	-34.07	44.98	95.97	-24.53	-18.18

% Difference = [(Compiled values − Recipe-Calculated values) / Recipe-Calculated values] × 100

Discussion

Preparing food at the household level typically involves unpredictable changes in composition. During cooking, water loss, protein denaturation, fat evaporation, and leaching of minerals and water-soluble vitamins through soaking and extraction are common occurrences. Additionally, nutrient availability may change, either increasing or decreasing, depending on the nature of the thermal treatment (Chen & Tengku Rozaina 2020; Dangal et al. 2024). Despite these challenges, traditional cooking methods remain integral to Bangladeshi foodways. The use of processed food is still relatively limited in Bangladeshi households, where most meals are prepared by conventional methods.

However, nutrient calculations based on Food Composition Tables (FCTs) that include only raw ingredient data may overestimate the nutrient content of cooked dishes. This discrepancy results in inaccurate estimations of actual dietary intake. Without recipe composition data (RCD) derived from cooked foods, assessments of diet-disease relationships remain inadequate (Ferrari et al. 2008; Deng et al. 2017). Therefore, the development of accurate food composition data (FCD) reflecting "as consumed" values is critical in the context of nutritional research and public health interventions in Bangladesh.

To bridge this gap, our laboratory has been involved in the chemical analysis of home-prepared dishes since 2003. In continuation of this effort, the present study analysed the proximate composition of four commonly consumed homemade curries and three festival dishes. A preliminary ingredient survey using a pretested questionnaire was conducted in 150 urban and peri-urban households across Dhaka city and Tangail district. The selection of dishes was based on frequency of mention and cultural relevance.

Sociodemographic data revealed that about two-thirds (68.7%) of the respondents were non-working homemakers, and around half (46.6%) were aged over 40 years. The majority (94%) were formally educated, and over 60% reported a family income between BDT 20,000 and 80,000 per month. This economic profile suggests that the selected recipes are accessible to and representative of a significant middle-income portion of the population.

The proximate analysis revealed, obviously, a reduction in moisture content in all cooked samples compared to their raw forms, attributed to water evaporation during cooking. Conversely, the concentrations of protein, fat, dietary fibre, and ash increased post-cooking due to the relative concentration of solids (Abdelhakam et al. 2022) .

In terms of retention factors, protein retention reached a maximum of 126.90%, supporting previous findings that heat processing enhances protein digestibility by inactivating antinutritional factors (Rani, Jood & Sehgal 1996). Fat retention was up to 105.92%, likely due to oil absorption and rupture of fat globules during cooking. Retention of dietary fibre and carbohydrate was also elevated, possibly due to the formation of resistant starch and Maillard reaction products (Chang & Morris 1990; Ramulu & Rao 1997; Sagum & Arcot 2000). These findings demonstrate that the standardized cooking procedures employed in this study were effective in minimizing nutrient losses. Overall, the observed patterns reinforce the need for cooked food data rather than reliance on raw-ingredient values. They also highlight a key limitation of raw FCT based assessments: they ignore cooking yield and structural changes in the food matrix that substantially alter nutrient density. Therefore, direct chemical analysis provides a more accurate understanding of the actual nutrient content of cooked dishes.

Quality assurance of the analytical process was implemented rigorously. The CV was used as an index of precision and relative error as an index of accuracy. For example, ash showed the highest CV (1.60%), which falls well within the acceptable range (<5%) for analytical methods (Nielsen 1994). Additionally, relative error for nutrient estimation in the IHRM standard sample was found to be less than 5% (Table 8), indicating the reliability of the analytical results (Chrysler Group LLC, Ford Motor Company & General Motors Corporation 2010).

Due to limitations of instrumental resources, secondary data sources were used to compile values of vitamins and minerals of public health interest using a data compilation method (Tables 9 and 10). Yet some gaps remained due to the unavailability of reference values. The extreme percentage differences between compiled and recipe-calculated nutrient values (Tables 11 and 12) demonstrate the limitations of applying European retention factors to Bangladeshi dishes. These factors assume shorter cooking times, minimal water loss, and different oil-use patterns, which do not reflect local practices such as prolonged boiling and repeated frying. As a result, recipe-based estimates often substantially overestimate or underestimate nutrients, particularly heat- and water-sensitive vitamins (e.g., vitamin C, B vitamins) and minerals affected by added salt or cooking intensity (e.g., sodium, copper). The large discrepancies such as >7000% for vitamin E and >90% for sodium highlight this mismatch. In contrast, compiled values already incorporate nutrient losses under culturally relevant cooking conditions, making them more accurate and contextually valid. Overall, compiled data provide a more reliable framework for assessing nutrient content in South Asian multi-ingredient dishes than recipe-based calculations using non-local retention factors.

Therefore, the nutrient data generated in this study may be considered as both accurate and precise. The results validate the analytical approach and the tradition of our laboratory to produce high-quality food composition data. As FCD provides the primary scientific basis for all nutrition-related assessments and interventions, the findings of this study are expected to contribute significantly to the national food composition database of Bangladesh.

This study thus offers essential information about the nutrient profile of traditionally consumed Bangladeshi dishes and underscores the importance of incorporating cooked recipe data into national dietary planning and health monitoring efforts.

Conclusion

This study produced a high-quality nutrient composition dataset for seven commonly consumed Bangladeshi dishes using direct chemical analysis supported by rigorously compiled secondary data. Nutrient retention factors were found to be dish-specific and in several cases exceeded 100%, highlighting that estimates based only on raw ingredient data are unreliable. Incorporating cooking yield and nutrient retention factors or ideally conducting direct analysis of cooked foods is therefore essential for generating accurate food composition values. The dataset developed here offers a validated resource that can strengthen the national FCDB and support improved dietary assessment, nutritional epidemiology, and public health policy in Bangladesh.

References

1. Abdelhakam, K.E., Mohamed, M.E., Farahat, F.H., Suliman, S.H., Elkhir, N.M. & Bushara, A.M., 2022, ‘Nutritional evaluation and effect of cooking methods on two types of chicken eggs’, *Journal of The Faculty of Science and Technology*, (9), 35–44.
2. Afrin, S.N.A., Akter, F. & Rahim, A.T.M.A., 2024, ‘Vegetable recipe variations in urban and periurban Bangladesh: Recipe survey, recipe standardization, and nutrient analysis’, *Bioresearch Communications*, 10(2), 1565–1572.
3. AOAC, 2000, *Official methods of analysis. The Association of Official Analytical Chemists*, 17th edn., Scientific Research Publishing, Maryland, USA.
4. Ara, G., 2003, *A study on the nutrient composition of homemade snack food: Calculated vs. analyzed values* – PhD thesis, M.S. Thesis, Institute of Nutrition and Food Science, University of Dhaka.
5. Arjoo, M., 2005, *Composition of Bangladeshi cook foods: Cooking yield and nutrient retention factor of festival foods* – PhD thesis, M.S. Thesis, Institute of Nutrition and Food Science, University of Dhaka.
6. Atwater, W.O. & Bryant, A.P., 1900, *The availability and fuel value of food materials*, Washington DC.
7. Begum, S., 2004, *Improving nutrient composition data of Bangladeshi dishes by applying cooking yield and nutrient retention data to recipe calculation* – PhD thesis, M.S. Thesis, Institute of Nutrition and Food Science, University of Dhaka.
8. Bithi, A., 2005, *Composition of Bangladeshi cook foods: Cooking yield and nutrient retention factors of homemade snack foods* – PhD thesis, M.S. Thesis, Institute of Nutrition and Food Science, University of Dhaka.
9. Bognár, A., 1998, ‘Comparative study of frying to other cooking techniques influence on the nutritive value’, *Grasas y Aceites*, 49, 250–260.
10. Chang, M.C. & Morris, W.C., 1990, ‘Effect of heat treatments on chemical analysis of dietary fiber’, *Journal of Food Science*, 55(6), 1647–1650.
11. Chen, S.Y. & Tengku Rozaina, T.M., 2020, ‘Effect of cooking methods on nutritional composition and antioxidant properties of lotus (Nelumbo nucifera) rhizome’, *Food Research*, 4(4), 1207–1216.
12. Chrysler Group LLC, Ford Motor Company & General Motors Corporation, 2010, *Measurement Systems Analysis*, 4th edn., AIAG (Automotive Industry Action Group).
13. CoFID, 2021, *McCance and Widdowson’s the composition of foods integrated dataset 2021 user guide*.
14. Dangal, A., Tahergorabi, R., Acharya, D., Timsina, P., Rai, K., Dahal, S., Acharya, P. & Giuffrè, A.M., 2024, *Review on deep-fat fried foods: physical and chemical attributes, and consequences of high consumption, European Food Research and Technology*, 250(6), 1537–1550.
15. Deng, F.E., Shivappa, N., Tang, Y.F., Mann, J.R. & Hebert, J.R., 2017, ‘Association between diet-related inflammation, all-cause, all-cancer, and cardiovascular disease mortality, with special focus on prediabetics: findings from NHANES III’, *European Journal of Nutrition*, 56(3), 1085–1093.
16. FCT, 2013, *Food composition table for Bangladesh*, Institute of Nutrition and Food Science, University of Dhaka, Dhaka.
17. Ferrari, P., Day, N.E., Boshuizen, H.C., Roddam, A., Hoffmann, K., Thiébaut, A., Pera, G., Overvad, K., Lund, E., Trichopoulou, A., Tumino, R., Gullberg, B., Norat, T., Slimani, N., Kaaks, R. & Riboli, E., 2008, ‘The evaluation of the diet/disease relation in the EPIC study: Considerations for the calibration and the disease models’, *International Journal of Epidemiology*, 37(2), 368–378.
18. Greenfield, H. & FAO, 1993, *Quality and accessibility of food-related data: Proceedings of the first international food database conference*.

19. Greenfield, H. & Southgate, D.A.T., 2003, *Food composition data*, 2nd edn., Elsevier Science Publishers, Rome.
20. HKI & WFP, 1988, *Tables of nutrient composition of Bangladeshi foods*, Bangladesh.
21. IFCT, 2017, *Indian food composition table*, National Institute of Nutrition, Indian Council of Medical Research, India.
22. INFOODS, 2017, *A compilation tool version 1.2.1 and user guidelines*.
23. INFS, 1992, *Deshio khaddyer poostiman (Food value of local foods) or DKPM*, University of Dhaka, Dhaka.
24. Kabir, S., 2010, *Ranna khaddo pusti*, Mowla Brothers, Dhaka, Bangladesh.
25. Mahbuba, U., 2018, *Recipe survey for homemade pickles among peri-urban housewives and proximate analysis of selected standardized recipes* – PhD thesis, M.S. Thesis, Institute of Nutrition and Food Science, University of Dhaka.
26. McCarthy, M.A., 1992, *Retention and yield factors*, *17th National Database Conference Proceedings*, Baltimore, MD, USA.
27. Mili, F.T.J. & Rahim, A.T.M.A., 2024, 'Nutrient composition of nine festival dishes obtained from a recipe survey among lower to middle-income households in selected urban areas', *Bioresearch Communications*, 10(2), 1516–1523.
28. Murphy, E.W., Criner, P.E. & Gray, B.C., 1975, 'Comparisons of methods for calculating retentions of nutrients in cooked foods', *Journal of Agricultural and Food Chemistry*, 23(6).
29. Mustary, Z., 2009, *A recipe survey of Bangladeshi foods and dishes and estimation of their nutrient content by using a recipe calculation program* – PhD thesis, MPhil Thesis, Institute of Nutrition and Food Science, University of Dhaka.
30. Nielsen, S.S., 1994, *Food analysis*, Springer US, Boston, MA.
31. Raghuramulu, N., Nair, K.M. & Kalyanasundaram, S., 2003, *A manual of laboratory techniques*, Indian Council of Medical Research, Hyderabad, India.
32. Ramulu, R. & Rao, R.U., 1997, *Effect of processing on dietary fiber content of cereals and pulses*, vol. 50, Kluwer Academic Publishers.
33. Rand, W.M., 1991, *Compiling data for food composition databases*, United Nations University Press.
34. Rani, S., Jood, S. & Sehgal, S., 1996, 'Cultivar differences and effect of pigeon pea seeds boiling on trypsin inhibitor activity and in vitro digestibility of protein and starch', *Food/Nahrung*, 40(3), 145–146.
35. Sagum, R. & Arcot, J., 2000, 'Effect of domestic processing methods on the starch, non-starch polysaccharides and in vitro starch and protein digestibility of three varieties of rice with varying levels of amylose', *Food Chemistry*, 70(1), 107–111.
36. Shaheen, N., Rahim, ATMA., Mohiduzzaman, Md., Banu, C.P., Bari, Md.L., Tukun, A.B., Mannan, M., Bhattacharjee, L. & Stadlmayr, B., 2013, 'Food Composition Table for Bangladesh'