A recipe survey for infants among mothers of mid income families and calculation of their nutrient composition

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Dedicated To My Supervisor

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Content

List of Tables and Box

Abbreviation

IMR	Infant Mortality Rate
UMR	Under-five Mortality Rate
SSHHS	South Sudan Household Survey
BDHS	Bangladesh Demographic and Health Survey
GAM	Global Acute Malnutrition
SAM	Severe Acute Malnutrition
NITWG	Nutrition Information Technical Working Group
SMART	Standardized Monitoring and Assessment of Relief and Transition
IYCF	Infant and young child feeding
NDB	Nutrient Database
BBF	Bangladesh Breastfeeding Foundation
FCT	Food Composition Tables
SSP	South Sudanese Pound
HMRI	Homemade recipes for infant
CYF	Cooking Yield Factors
FCTB	Food Composition Table for Bangladesh
YF	Yield factor
RF	Retention factor
FEP	Factor of Edible Part
RW	Raw Weight
CW	Cooked Weight
NVs	Nutritive Values
INFS	Institute of Nutrition and Food Science
ND	Nutrient Density

RDA	Recommended Dietary Allowances
NFE	Nitrogen-Free Extract
INFOODS	International Network of Food Data Systems
FAO	Food and Agriculture Organization
FSNMS	Food Security and Nutrition Monitoring report for South Sudan
CV	Coefficient of Variation
SD	Standard Deviation
QC	Quality Control
SRMs	Standard Reference Materials
NIST	National Institute of Standards and Technology
IHRM	In-House Reference Materials

Executive Summary

Background

Mixed dishes or multi-ingredient foods (Recipes) represent the majority of items in diets worldwide. Dietitians, nutritionists, and epidemiologists need composition data of these foods to evaluate the role of these foods in the health of individuals. Obtaining and using data on the content of multi-ingredient foods presents a number of inherent difficulties, primarily because of their abundance, diversity and variability. Analytic data do not exist for most of these foods. Analytic data for recipes are not generally as available as they are for single foods. The calculation of the nutrient content of these foods from the nutrient data of the ingredients are estimates and not meant to replace nutrient values obtained by laboratory analysis.

However, because of the difficulties and costs of analyses of mixtures of different food types, and limitations on resources to adequately sample these mixtures, calculated values that rely on a broad base of representative samples may actually be more accurate than values derived from laboratory analysis of one or two samples of the prepared food. For many foods, recipe calculation may be the only cost-effective way to obtain nutrient data.

The present study focuses on the compositional analysis of *homemade recipes for infants* (HMRI), an area of food compositional data production program that is very often not given proper attention.

Objectives of the study

1. To conduct a recipe survey among mid-income households from two geographical areas of the World to collect a list of HMRIs
2. To standardize selected HMRIs for proximate analysis in order to calculate their *Cooking Yield Factors* (YF).
3. To calculate missing nutrients values of analyzed recipes by using a recipe calculation programme developed in our lab.
4. To compile analyzed and calculated nutrient values by using FAO/INFOODS Compilation Tool version 1.2.1, a food composition database management system in Excel.
5. To generate a ranked HMRI list on the basis of nutrient and calorie density for the general use.

Methodology

Recipe survey

A survey on homemade recipes for infant feeding practices was conducted in a selected area of Dhaka city among mothers of mid income families using a pre-tested structured questionnaire. For geographical comparison of *Young and Infant Feeding Practices* (YIFP), another recipe survey was conduct in different Payams of Juba County, Capital of South Sudan.

Recipe standardization

Standardization of recipes was done as described in our earlier studies (Zaheda 2007). Briefly, the median values of ingredients of a recipe were taken from the amounts of ingredient cited by the survey respondents.

Proximate analysis of selected HMRIs

To minimize cost of chemical analysis and to obtain a fresh cooking YF for each recipe, only proximate analysis of selected HMRIs were conducted. All analysis of proximate nutrients was performed using AOAC methods.

Calculation of minerals and vitamins by a recipe calculation program

Estimation of minerals and vitamins of the HMRI were conducted by a web-based recipe calculation program developed in our laboratory, which uses the *Mixed Recipe Method* recommended by FAO/INFOODS. The nutrient profile of selected HMRIs was then compared with other reported values and compiled to get a complete compositional data for these HMRIs.

Results

Upon standardization with a cut-off point of minimum citations of an ingredient, 27 recipes were identified that were daily or frequently prepared by the respondent families from both geographical regions. About 70% of the studied households were found to prepare these HMRIs for their babies regularly.

A total of 9 HMRIs were selected for proximate nutrient analysis; 8 recipes from commonly cited categories from Bangladeshi food and one recipe selected from Sudanese common categories. On the other hand, mineral and vitamin content and composition were estimated by a web-based recipe calculation program developed by our laboratory.

The finding shows that *Bean soup* among the nine HMRI shows highest ND score while *Maggi soup* shows the lowest ND score. While comparing the nutrient density with RDA for the infants showed that in most case among all HMRIs analyzed, *Sobji khichuri* fulfills up to 90% energy, 93% fat, 100% protein needs quantitatively per servings of the recipe eaten. However the quality of protein and fat in *Sobji khichuri* cannot be revealed from this study

Conclusion and Recommendation

The findings suggested that the HMRIs studied are relatively more nutritious foods to infants and young children. Since homemade recipes are fresh and more nutritious than commercial foods, mothers should prefer this type of foods in their IYFP for better growth and development of their children.

The findings of this study may be incorporated in child feeding manuals because they are not only use to cook but also full of nutrients.

1. Introduction

Poverty, ignorance and lack of knowledge about the age specific diet are a leading cause of primary malnutrition. In many developing countries as well as in Bangladesh also have some taboos, complementary foods are introduced too early or too late and the quality and quantity of the foods are insufficient which leading to a greater risk of nutritional deficiencies during the second half of infancy. Most of them were habitually used complementary foods in developing countries are unfortified cereal based gruels which are which are characterized by limited sufficiency of energy, absence of protein, inadequate access of micronutrient.

According to the BDHS 2013, in Bangladesh, complementary foods are introduced among 36% infants as early as 1 month of age and by the age of 6 to 7 months only 68% of the breastfed children received semisolid or solid foods as per the complementary feeding recommendations. The quality of diets is also poor, with only 25% of infants being fed vitamin A rich foods and as little as 10% receiving animal foods. On the other hand, South Sudan is one of the countries with highest mortality rates globally. Infant Mortality Rate (IMR) and Under-five Mortality Rate (UMR) are very high at 102/1000 live births and 135/1000 live births respectively South Sudan House Hold Survey (SSHHS) 2006. According to Nutrition Information Technical Working Group (NITWG) SMART survey in 2014-2015 in Juba County reflected a Global Acute Malnutrition (GAM) rate of 6.4 and Sever Acute Malnutrition (SAM) rate of 0.5%. There were variations in prevalence of malnutrition in different counties.

The main focus of the this study is to collect homemade infant recipes to find out the nutritional gaps through analysis of recipe nutrient composition and compare and contrast the findings between two geographical regions of the World so that the mothers could choose age appropriate ideal recipe for their young children. Major recipe data were collected from Mirpur Area of Dhaka and few recipes were collected from metropolitan Juba capital of South Sudan.

2. Rational of the study

Under nutrition and poor nutritional status of infants and young children is highly prevalent in low and middle-income countries causing a substantial mortality and morbidity[1]. Bangladesh is still one of the 24 countries with the highest burden of stunting in the world[2]. According to the World health statistics 2015, in Bangladesh, infant exclusive breastfeeding rate were 45%, wasting of under five children were 14%, stunting of under five children were 36%, and 33% of the under five children were found underweight.

Concerning the Infant and Young Child Feeding (IYCF) key information on Infant age starts from birth up to 12 months of age and young child age start from12 months up to 24 months of age. Complementary feeding is the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants and therefore other foods and liquids are needed along with breast milk. The age range for complementary feeding is generally taken to be 6 up to 24 months.

Many surveys show the impediment to introduce complementary food to infant and find as usual the same problem. According to BBF/BDHS/BSS/UNICEF 2003-2004, in Bangladesh complementary foods are given to infants and young children are often nutritionally inadequate and unsafe which leading to malnutrition[3].

Appropriate complementary feeding depends on accurate information and skilled support from the family, community and health care system. Inadequate knowledge about appropriate foods and feeding practices is often a greater determinant of malnutrition than the lack of food[4].

The aim of the study is to increase knowledge to start complementary feeding at right time of age, how do start safe complementary feeding practice and how to know about nutrients facts of homemade complementary food. The study will also to address these following issues:

2.1. Recipe collection for infants from mid income families:

In Bangladesh 50% people are middle-income group people[5]. Therefore recipe collection survey was carried out among mothers of this income group population. Through the middle-income group of South Sudanese population were not clearly characterized by any their government agencies, we tried to collect recipes comparing their relative daily income.

2.2. Characteristics of Homemade recipes for infant (HMRI):

Homemade recipes for infant (HMRI) are a popular option for parents instead of commercial alternatives for their children. But they remained unaware about HMRI nutrient composition and health benefits. Nevertheless, HMRI is popular because of the following characteristics:

1. It is cheaper and fresh.
2. Its texture and flavor can be determined that suites the infants.
3. It can have wide variety so that parents can choose a plenty.
4. It has option to choose different ingredients so that HMRI nutrient density can be increased.
5. It helps infants to get used to family foods.
6. It can be prepared instantly.

3. LITERATURE REVIEW

3.1 Foods are suppliers of nutrients

Foods satisfy hunger. No doubt about that, however, food is basically a supplier of nutrients to the body. Hence its nutritional function is naturally understood to be of primary importance. Food provides us with the energy we needs for growth, physical activity and for basic body functions (breathing, temperature control, blood circulation and digestion). Food also supplies us with the mineral to build and maintain the body and to promote resistance to disease. These different functions are made possible by the nutrients contained in food. The types of nutrients in food are: carbohydrates, proteins, fats, vitamin, minerals and water. All foods contain one or more of these nutrients in varying amounts. Each type of nutrient serves particular functions.

3.2 The quality of food

Historically, the quality of foods has long been evaluated on the static properties of foods that can be defined by chemical, physical, and instrumental analysis. This concept, however, changed when a new era began in the mid sixty's with the rapid development of the economy. The interest in the quality of foods largely shifted from nutrition to preference related to sensory satisfaction, particularly in the west. Up to this era a large number academic and public interest have been attracted to the functions of foods that had been studied mostly from the aspects of nutrition and preference only.

A different situation arose in the 1980's when the problems of rapidly advancing aged population become alarmingly visible in the west and to a lesser extent in the developing countries too. Accordingly, public attention gradually moved toward how to prevent adult and geriatric diseases through daily dietary practice. In connection with this situation, basic studies were instigated to gain scientific insight into the tertiary function of foods that could be expected to contribute disease prevention. Nowadays, it is generally understood that the quality of any food should be defined in terms of a variety of dynamic function, which the food exerts after ingestion. Actually a great many studies have been done in recent decades to demonstrate that there are a variety of substances originating in food with tertiary functions that can be expected to be involved in preventing diseases by modulating the

immune, endocrine, nerve, circulatory, and digestive systems. As a matter of fact, a number of substances, which possibly contribute to the modulation of these physiological systems, have been identified.

However, **in the developing countries like Bangladesh food quality still refers to nutrient content and composition of foods** rather than its tertiary functions. Because the nutritional adequacy of individual foods and of diets are more important in developing areas than in areas where food supplies are more adequate.

3.3 Need of food composition data

Failures to understand the relationships between diet and health or disease are often due to inadequacies in food composition or food consumption data.

Many foods contain nutrients in various proportions; some foods provide only a single nutrient whereas some foods are rich in certain nutrients. But lack of our knowledge in their composition often deprives us of making a proper use of them. Adequate knowledge of the nutrient contents of these foodstuffs would help us in preparing a diet which shall be balanced qualitatively as well as quantitatively.

Diets of human populations are extremely complex. Maximal insight into the relation between diet and disease will usually be obtained by examining diets both as constituents and as foods. Calculations of intakes of nutrients and other constituents require a food composition database that is complete and current.

3.4 Data on cook foods in Bangladesh

The primary objective of Nutrient Database (NDB) or Food Composition Tables (FCT) is to provide data on the nutritional value of foods of all sorts i.e., raw, cooked, single item, mixed dishes, and recipe variation as well as cooking yield, nutrient retention value, etc.

Virtually all of the tables available in Bangladesh list nutrients for uncooked food items, which means that since many nutrient values change with cooking these listings do not accurately reflect what is actually consumed. Values that cannot be averaged from actual analytical data can be calculated using analyzed values. For cooked foods, calculations are based upon analytical values for the raw products then adjusted for yield and retention factors. However, calculated values provide a different finding of data than those from direct analysis. The quality of calculated

values thus depends on the quality of the original analytical values and the accuracy of calculation procedures.

Regional food composition tables also do not meet accuracy requirements when the analysis involves foods that are not consumed raw, and where the presence and amount of nutrients in foodstuffs are very dependent on local conditions, mainly soil composition.

Since food composition data on cook foods is much needed one in the country, our laboratory has taken initiative to carry on systematic analysis of homemade foods.

Concentrations of nutrients in foods and dishes that have been prepared for consumption by customary Bangladeshi procedures have been analyzed in our laboratory for the last ten years (see Table 1; section Literature). For this purpose recipe surveys were conducted and collected recipes were standardized and food samples were prepared accordingly followed by laboratory analysis for nutrient concentration.

Table 1: List of studies conducted at our laboratory on foods and dishes prepared by customary cooking process

Year	Title	Reference
2005	Composition of Bangladeshi Cook Foods: Cooking Yield and Nutrient Retention Factors of Homemade Snack Foods	*Akter Jahan* M.Sc. Thesis, INFS, DU
2005	Composition of Bangladeshi Cook Foods: Cooking Yield and Nutrient Retention Factors of Festival foods	*Mahajabeen Arjoo* M.Sc. Thesis, INFS, DU
2005	Composition of Bangladeshi Cook Foods: Cooking Yield and Nutrient Retention Factors of Traditional Cakes	*Shaima Arzuman Shahin* M.Sc. Thesis, INFS, DU
2005	Composition of Bangladeshi Cook Foods: Cooking Yield and Nutrient Retention Factors of Desserts	*Mashuka Binte Zaman* M.Sc. Thesis, INFS, DU
2004	Improving Nutrient Composition Data of Bangladeshi Dishes by Applying Cooking Yield and Nutrient Retention Data to Recipe Calculations	*Sabila Begum* M.Sc. Thesis, INFS, DU
2003	A Study on the Nutrient Composition of Homemade Snack Food: Calculated vs. Analysed Values	*Gushan Ara* M.Sc. Thesis, INFS, DU

The target of these studies is to analyze chemically one standardized recipe of a food item among available recipes. So that non-analytic values of nutrients in other recipes of the same food item can be obtained by recipe calculation.

3.4.1 Meaning and use of Recipes

A recipe is a guideline to prepare the specified dish. It generally consists of three parts: enumeration of ingredients, instructions and characteristics for evaluation of the result. Rogov (2006) defines recipes as “A written recipe is a kind of permanent reference and both chefs and cookbook writers will do well to keep in mind that the primary purpose of any recipe is to aid the writer or those who later read the recipe to prepare the dish being described.”

Zacharias & D¨urr (1992) demand that ingredients should be named in their usual denotation and accepted measures (teaspoons and the like are only permitted if the success is not endangered, but spices do not necessarily need to be given in precise amounts). The procedure should be written in keywords or full sentences, and a rational method of operation should be made possible. Lastly, characteristics for evaluation should contain the expectable yield, the look and consistency and if desired nutritional information.

3.4.2 Sources of Recipes

Today, cookbooks are only one possible source of recipes. McKie & Wood (1992) identify about 20 different possibilities to obtain recipes, of which the cookbook is the most frequently used. More than half of their sample owns between four and ten cookbooks. The authors furthermore report that 88% of the women and 75% of men share recipes with family, friends and neighbors and that 64% of women and 50% of men read recipes for pleasure. Interestingly, Hertzler & Bruce (2002) find that the sources of recipes are similar for both sexes, except for cookbooks, which are significantly used more often by female students.

3.4.3 Nutrient composition of recipe

Analytic data for recipes are not generally as available as they are for single foods, with data especially lacking for ethnic and regional dishes, many variations of homemade and restaurant-made foods, and the numerous varieties of industrially prepared canned, frozen, and packaged entrees. The calculation of the nutrient content of recipes from the nutrient data of the ingredients are *estimates* and not meant to replace nutrient values obtained by laboratory analysis. However,

calculating the values is an intermediate solution until adequate analytic data become available.

Because of the difficulties and costs of analyses of mixtures of different food types, and limitations on resources to adequately sample these mixtures, *calculated values* that rely on a broad base of representative samples may actually be more accurate than values derived from laboratory analysis of one or two samples of the prepared food. **For many foods, recipe calculation may be the only cost-effective way to obtain nutrient data.** In some of these cases it is possible to estimate the needed data on the basis of data from a "similar" food in a dish. It may be a biologically similar food (e.g., a different variety of potatoes for *alu vorta*), or a different form of the same food (e.g., raw for cooked). The basic problem is the choice of a food which is "close" to the food of interest.

3.5 Generation and recording of food composition data

It is probably unnecessary to point out that the generation and recording of food composition data represents a difficult problem in comparison with, for example, data in physics and chemistry, where information about atomic structure and bond energies is determined under highly standardized and reproducible conditions. In the context of foods, analysis is made on living or deteriorating material, and there is also variability between and within foods. Although this is not surprising, since biological variability is one of the major prerequisites of life, it does add to the complex task of achieving an orderly accumulation of composition data on foods consumed by people. Furthermore, the enormous variety of foods eaten represents a crucial problem with respect to the identification of foods and their systematic classification.

The precision found in chemistry and physics rests on the ability to repeat experiments under highly defined conditions in different laboratories. Comparable precision in the determination of food composition is not achievable, but further efforts must be made in this area to improve the quality of food component data. In any event, data should be generated and presented according to accepted criteria or guidelines, with adequate descriptions of the procedures utilized, including concern for sampling and coding, as well as analytical chemistry.

3.5.1 Features of food composition data

A food composition dataset may contain some values obtained from chemical analysis of the food as well as other non-analytic values which are calculated from conversion factors or estimated from other knowledge about the food. Chemical analyses of nutrients in foods are costly and often unavailable for foods not commonly consumed or for nutrients of lesser interest. To provide a complete nutrient database, it is often necessary to calculate nutrient values from available analytic data using defined algorithms or estimate values using other sources of data. Non-analytic values may be described as imputed, calculated, or estimated (Rand *et al.,* 1991). Estimated values frequently are calculated values, but they may also require additional assumptions, such as the proportion of ingredients in a frozen entree and the nutrient contribution of each ingredient (Gebhardt, 1992; Schakel *et al.,* 1989; Westrich *et al.,* 1994).

3.5.2 Chemical analysis of recipe: Rationale for proximate analysis

The primary objective of food composition databases is to provide the users with compositional information on energy-yielding nutrients; therefore the primary factor in the choice of methods is the appropriateness of the analysis in terms of providing the information required by the users. At this juncture it is felt in our experiences that **the urgent and minimum data of recipe that are required by the users can be met by doing their proximate analysis.**

It is incorrect to give the impression that nutrient analyses cannot be performed without currently available sophisticated instrumentation; for many nutrients classical manual methods are available that give equally sound values. These methods are labour-intensive rather than capital-intensive (Greenfiled and Southgate 2003).

The proximate system for routine analysis of animal feedstuffs was devised in the mid-nineteenth century at the Weende Experiment Station in Germany (Henneberg and Stohmann, 1860, 1864). It was developed to provide a top level, very broad, classification of food components. The system consists of the analytical determinations of water (moisture), ash, crude fat (ether extract), crude protein and crude fibre. Nitrogen-free extract (NFE), more or less representing sugars and starches, is calculated by difference rather than measured by analysis. However, many people find the concept and term “proximate” useful to represent the gross

components that make up foods; the actual analytical methods then become independent.

The methodology for the proximate system of recipe analysis is elaborated in methods and material section

3.5.3 Non-analytical values of recipe: Recipe calculation approaches

The procedure for recipe calculation incorporates the following considerations:

- ⇒ The procedure assumes that data are available on each of the ingredients which are then combined and, if necessary, prepared. If a recipe calls for one or more ingredients which must be prepared from recipes (e.g., a sauce or a stock), the calculation procedure must first be applied to each of these ingredients separately, and then to the final product using the results of the initial recipes as ingredients.
- ⇒ This procedure recommends nutrient adjustment of individual ingredients before their combination, with a final adjustment for weight. This is a slight distortion of what often happens when ingredients are combined and then prepared.
- ⇒ This procedure produces ESTlMATES of nutrient content of multi-ingredient foods.

Several approaches are used to calculate nutrients for recipes. Each of the strategies may be suitable in certain circumstances; however, none of the approaches is without limitations. Three approaches are summarized in Box 1 below. The comparison of the methods shown as discussed in the literature revealed that the most commonly used method was a procedure that applied an YF at the recipe level and the RF at the ingredient level as shown in Box 1.

Table 2: Recipe calculation approaches

Recipe methods	Main steps	Advantages	Disadvantages
Ingredient method: Aggregate nutrients for weights of raw ingredients	**Ingredient 1: NV x 1/YF x RF** **Ingredient 2: NV x 1/YF x RF** **Ingredient 3: NV x 1/YF x RF** **----------** **Recipe: Sum of above**	○ Weight loss at ingredient level is known which helps to calculate value of cooked food ○ No need to know the recipe category ○ Unequal weight of ingredients is taken into account	○ Appropriate only for i. calculating the nutrients in uncooked recipes where the weights of the ingredient are indicated for edible portion ii. when no losses occur during the food production process ○ For cooked foods, this method may over estimate some nutrients per portion size
Recipe method: Aggregate nutrients for yield adjusted weights of finished form of ingredients	**Ingredient 1: NV** **Ingredient 2: NV** **Ingredient 3: NV** **----------** **Recipe:** **Sum of above x 1/YF x RF**	○ Applicable for both uncooked and cooked foods ○ YF are utilized to adjust ingredient weights to reflect changes in weight during cooking process	○ Several yield factors may needed: i. Preparation YF ii. Cooking YF iii. Consumable YF ○ Loss of nutrients due to cooking may not be proportional to the moisture loss due to evaporation ○ Different YF for different ingredients may cause under or over estimation of nutrients ○ Nutrient may not be available for some cooked ingredients
Mixed method: Aggregate yield adjusted weights of ingredients and adjust nutrients for raw ingredients using RF	**Ingredient 1: NV x RF** **Ingredient 2: NV x RF** **Ingredient 3: NV x RF** **----------** **Recipe: Sum of above x 1/YF**	○ This is suitable for both uncooked and cooked foods ○ Food production process is considered to make appropriate adjustments for losses or gains in ingredient weight. ○ Precise and complete	○ Difficult to estimate RF which has been subjected to a number of cooking processes ○ RFs are available for only a limited number of foods. ○ Effect of cooking time and temperature on nutrient retention (NR) is not reflected in adjustment process

3.5.4 Recipe compilation procedure

The International Network of Food Data Systems (INFOODS) and FAO have published a number of guidelines to compile secondary food composition data (Ref). Of these publications the FAO/INFOODS Compilation Tool version 1.2.1, a food composition database management system in Excel (http://www.fao.org/infoods/infoods/software-tools/en/) is recommended for a comprehensive tool for data compilation. They key steps of this toolkit are:

i. Compilation of Published and Unpublished Data
ii. Systematic Development of Archival Files
iii. Estimation of Missing Nutrient Values
iv. Borrowing and Adapting Data from other Regional and International Databases for Local Use
v. Adjustment for water and fat changes
vi. Development of the Reference Database
vii. Development of User Database

4. Objective

4.1 General objective:

To construct a food composition database for homemade recipes for infants.

4.2 Specific Objective:

1. To conduct a recipe survey among mid-income households from two geographical areas of the World to collect a list of HMRIs
2. To standardize selected HMRIs for proximate analysis in order to calculate their *Cooking Yield Factors* (YF).
3. To calculate missing nutrients values of analyzed recipes by using a recipe calculation program developed in our lab.
4. To compile analyzed and calculated nutrient values by using FAO/INFOODS Compilation Tool version 1.2.1, a food composition database management system in Excel (http://www.fao.org/infoods/infoods/software-tools/en/).
5. To generate a ranked HMRI list on the basis of nutrient and calorie density for the general use.

5. Methods and Materials

5.1 Recipe survey and standardization

5.1.1 HMRI survey among mothers in metropolitan Dhaka

The recipe was conducted purposively among 100 mothers of middle-income families living in Mirpur area. A pretested survey questionnaire prepared and the mothers were interviewed face-to-faces with the study instrument. The mothers were asked to describe at least 5 recipes they used to prepare for their infants. More than 408 recipes for infants were collected in this process. A 24-hour dietary recall was also conducted along with the interviews to collect dietary intake profile of the infants. Also collected were the information on seasonality, availability, and preparation frequency of the foods they consumed in order to develop a key food list. Other relevant information regarding recipe preparation was also collected.

5.1.2 Recipe survey in Juba Central Equatorial State of South Sudan

A cross sectional survey was conduct in different *Payams* (A payam is the second-lowest administrative division, below counties, in South Sudan. Payams are required to have a minimum population of 25000)of Juba county to collect some local recipes for 6 month to 2 years children.Here also a pre survey questionnaire was prepared for interviewee. The respondents were asked about recipes, which are usually cooked for their children. Total 150 recipes were collected from 50 families which they prepare for their children.

5.1.3 Standardization of recipe

Standardization of recipes as described in Table 3 was done by accepting the most cited ingredients in a recipe. Selected recipes from these groups were listed up. Table 4 & 5 showed the standardization procedure with a Bangladeshi and with a South Sudanese recipe.

Table 3: Recipe standardization protocol

1. Listing the name, amount, size or volume of each ingredients of a homemade infant recipe. Only those recipes were listed which was cited by the respondents at least ≥1% of the total citation of all recipes which they prepared at least once in a day.
2. The least cited ingredient of a particular recipe and its variety was considered as ≤10% of total citation. It was dropped from the recipe's ingredient list.

3. The ingredient list of a standardized recipe of a particular item was determined by including the ingredients which had the amount or volume most frequently used in the recipe. In order to do this the mode of citation of an ingredient across similar recipes was used. Where more than one mode appeared, then mean of the modes were used to quantify the ingredient in the standardized recipe.

Table 4: Example of a standardization protocol for a Bangladeshi foods (Vegetable khichuri)

Ingredients	1st recipe	2nd recipe	3rd recipe	4th recipe)	5th recipe	Standardized Recipe (Mode of citation of the ingredients
Rice (g)	100	100	100	200	250	100
Red lentils (g)	50	60	50	50	100	50
Pumpkin (g)	5	5	15	12	10	5
Indian spinach (g)	5	5	15	12	10	5
Onion (g)	20	20	20	20	20	20
Salt (g)	4	4	2	4	4	4
Potato (g)	5	5	15	2	1	5
Turmeric (g)	2	1	1	50	20	2
Green chili (g)	1	1	1	2	1	1
Oil (g)	20	20	5	50	20	20
Water (g)	250	1000	250	1000	1000	1000

Table 5: Example of a standardization protocol for a South Sudan food (Porridge)

Ingredients	1st recipe	2nd recipe	3rd recipe	4th recipe)	5th recipe	Standardized Recipe (Mode of citation of the ingredients
Maize Flour (g)	300	300	300	300	300	300
Sugar (g)	15	15	30	30	15	15
Salt (g)	0.25	0.25	15	25	0	0.25
Oil (ml)	10	10	10	10	0	10
Milk (ml)	200	200	300	200	0	200
Peanut Paste (g)	30-45	30-45	45-60	0	15	45
Water (ml)	500	500	500	600	600	500

5.1.4 Handling and Preparation of Food Items

To assure general nutrient stability of the food matrix, nutrient content and representativeness of a sample, proper handling of sample units and composites is critical. So ingredients used for the preparation of the food items when purchased from local markets was given most priority to buy the best-preserved, good quality, and freshly available goods. They were carried to the laboratory in cellophane or airtight plastic bags or packets. The ingredients were used immediately for food preparation using the standardized recipes.

5.2 Chemical analysis of proximate nutrients of the selected HMRI

Twenty Seven most widely cited recipes were selected by the respondents and for the preparation of standardized recipes. In total eight Bangladeshi recipes & one South Sudanese recipe nutrient content in cooked forms was determined in our laboratory.

5.2.1 Preparation of Laboratory Sample

Cooked samples were covered with cellophane paper and brought to laboratory within a refrigerated box. Samples of each item were blended to make a homogenous mixture. Portions of each item were removed for moisture and ash analysis. Homogenous samples were then oven dried followed by grinding into powder. Powdered samples were passed into a 40 mm mesh to prepare even-sized particles. They were taken into vinyl bottles and capped under nitrogen flush followed by desiccation until further analysis.

5.2.2 Sample drying

Water loss from a sample during analysis is a function of *time* and *temperature*. Decomposition enters in the picture when time is too much or temperature is too high. Thus, most methods for food moisture involve a compromise between times at particular temperature at which limited *decomposition* might be a factor (Bradley RL1994). Therefore it is the suggestion of the experts that the physical process of drying must separate all the water without decomposing of any of the constituents that could release water or loss of food constituents (Bradley RL 1994).

Since Curry dishes is rich in protein, carbohydrate and lipid, decomposition is likely to occur. So a lower temperature under vacuum, such as 70^0 C, as suggested in Pearson's book (Kirk and Sawyer 1991) was the best option for sample drying. A temperature of 80^0 C for overnight (up to 10 hrs) was used in the present study to dry food samples without vacuum. This 10 point higher temperature than the suggestion was used because to cope with the lowering effect of humidity on the rate of loss of water. It is the experience of our laboratory from over 600 estimations of reproducible results in such a drying condition.

5.2.3 Estimation of moisture:

Moisture content was estimated according to the method of Pearson (Pearson1970). 5 grams of sample was taken in a constant weight porcelain crucible, which was previously heated to 100^0 C and cooled in a dedicator followed by weighting. The crucible was then placed in an oven and heated for 6 hours at 105^0 C. It was then cooled to room temperature in a desiccators and weight. The process of heating, cooling and weighing was repeated until the weight became constant. Moisture content was then calculated as per cent water loss as follows:

Calculation:

$$\textbf{Moisture content \%} = \frac{W_a - W_b}{W_a} \times 100$$

Here: W_a- initial weight

W_b- weight after drying

5.2.4 Estimation of ash:

Estimation of ASH of the curry dishes was done using the AOAC (1994) method. Fresh samples were incinerated in a muffle furnace at 600º C for six hours. Briefly, 3 g of cooked samples were taken in a porcelain crucible, which was previously heated to 100º C and cooled and weighed. The crucible with the sample was first heated in an oven till (3-4 hrs) all material was completely charred, then heated in a muffle furnace for five hours at 600º C. It was then cooled in a desiccator and weighed. To ensure formation of complete ash, the crucible was again heated at the muffle furnace for half

an hour, cooled and weighed. This step was repeated until two consecutive weights were same and the ash was almost white in colour. Two duplicates were taken for each sample. The ash content was calculated using the following formula:

Calculation

$$\textbf{Ash \%} = \frac{\textit{Weight of ash}}{\textit{Weight of sample}} \textbf{ x 100}$$

5.2.5 Estimation of protein:

The protein content was determined by Kjeldahl method no. 984.13 (AOAC 2000, 17th edition) modified in our laboratory at a micro scale to reduce reagent cost. This "micro Kjeldahl" method has been used for food protein estimation in our laboratory for the last 15 years and proved to be very handy and gives satisfactory and reproducible results.

The Kjeldahl method for the determining the total nitrogen involves heating with conc. sulphuric acid in a Kjeldahl flask. Added to acid is digestion mixture containing potassium sulphate to raise the boiling point and a catalyst copper sulphate ($CUS0_4$) to accelerate reaction rate. The oxidation causes the nitrogen to be converted to ammonium sulphate. After making alkaline with conc. sodium hydroxide (NaOH) solution, ammonia (NH_3) is distilled into excess dilute sulphuric acid solution. The amount of NH_3 trapped in acid is then back titrated with same strength of NaOH. In most routine purposes crude protein in the sample is calculated by multiplying the total nitrogen by an empirical factor 6.25 (AOAC 2000).

Reagents:

i. **Standard O.1N H_2S0_4 solution:**

In a 500 ml measuring cylinder, 1 ml concentrated H_2S0_4 was taken and diluted to make 360 ml solution with dist water. It was then standardized by titration with 0.1 N sodium carbonate solutions.

ii. Standard O.1N Na_2CO_3 solution:

The solution was prepared by dissolving sodium carbonate (0.53 g) in 100 ml distilled water.

iii. **Sodium hydroxide**, 32% in dist water.

iv. Standard O.1N NaOH solution:

The solution was prepared by dissolving NaOH (0.4 g) in 100 ml distilled water.

v. Digestion mixture:

Potassium sulphate and copper sulphate was mixed in the proportion of 98:2 (w/w).

vi. Methyl red (indicator):

Methyl red (0.l g) was dissolved in alcohol (60 ml) and the volume was made 100 ml with distilled water. The insoluble particles were removed by filtration using filter paper.

Digestion: One gram of cooked dried samples of was taken in a clean and dry 500 ml Kjeldahl flask. To this 25 ml conc. sulphuric acid and 5 g digestion mixture were added. The flask was heated carefully at a low temperature until the mixture no longer froths, and then the temperature was increased so that the flask boiled briskly. The flask was occasionally rotated and agitated to ensure complete digestion of the samples. The mixture was digested until the black carbon deposit was oxidized and the solution become clean. To ensure complete digestion the heating was continued for an additional hour. The flask was then cooled and the digested materials were transferred into a 100 ml volumetric flask and distilled water was added to make a final volume. A blank was run simultaneously with all the reagents except sample.

Distillation: Before starting distillation the apparatus was thoroughly washed with distilled water. Fourty millilitres (40 ml) of 0.1 N sulphuric was taken into the receiving 100 ml ground-joint round bottom flask. Two drops of indicator was added to it. The flask was so placed that lower part of the delivery tube extending from the condenser was immersed into it. A few pieces of pumice stone were added in to a 500 ml round bottom flask to prevent bumping. Twenty millilitres (20 ml) of digested solution was taken into it, and then excess amount of (75 ml) 32% sodium hydroxide was added. The flask was immediately connected with the distilling system. The

solution was first heated slowly and then the heating was so adjusted that the mixture boiled at such a steady moderate rate. The distillation was continued unit the volume of the receiving flask became approximately doubled. At the end of distillation, the distilling condenser was then mixed with water and the washing was added to the distillate. The ammonia absorbed in the receiving flask was then titrated back with 0.11N NaOH. The reagent blank was distilled and titrated similarly. The percentage of protein was calculated from the given formula:

Calculation

$$\textbf{Protein content (g/100 g sample)} = \frac{(c - b) \times 1.4\ d \times 6.25}{a}$$

Where,

a = Weight of the sample in gm

b = Volume of alkali for sample titration (ml)

c = Volume of alkali for blank situation (ml)

d = Strength of alkali (iv)

6.25 = Gravimetric factor for proteins in foods (15% nitrogen in protein)

5.2.6 Estimation of fat:

The Soxhlet procedure described in (Method no.991.36, AOAC 2000) was used to estimate total crude fat. The fat was extracted from the dried sample (5g) using petroleum ether (40-60 boiling range) as a solvent. The sample was taken into a filter paper, folded into square size, tied with ether-washed thread and dipped into the extraction tube. Added to the boiling flask was 100 ml of petroleum ether. Soxhlet extractor was extracted at a rate of 5 or 6 drops per second condensation. Each extraction lasted eight hours. At the end the extraction the extract was removed from the flask and initially dried to a minimal volume in a hot water bath. It was transferred into a small pre-weighed conical flask followed by nitrogen flash to remove all traces of petroleum ether. The flask was then soaked with tissue paper to dryness and weighed.

Calculation

$$\textbf{Lipid content (g/100 g)} = \frac{\textbf{Lipid content (g/100 g)}}{\textbf{Wt. of the sample taken}} \times 100$$

5.2.7 Estimation of carbohydrate:

The nitrogen free extracts (NFE) Or Carbohydrate was obtained by subtracting the sum of the values for moisture, protein, fat and ash from 100 (Ferris et al.1995). This value was considered as "total carbohydrate" and was calculated by following equation.

Carbohydrate (NFE g %) =100 – (Protein+ lipid +DF+ moisture +ash) g/100 g

5.2.8 Estimation of Energy:

The energy content of the samples was calculated by using the conversion factors of protein, fat and carbohydrate. The conversion factor used are 4.0 kcal/g for protein,4.0kcal/g for CHO and 9.0 kcal/g for fat(Whitney ,et al,1987;Ferris et al,1995).

5.2.9 Calculation of Cooking Yield Factor:

The cooking yield was determined as follows:

$$\textbf{Cooking Yield \%} = \frac{\textbf{Weight of food after cooking in g}}{\textbf{Weight of food before cooking in g}} \times 100 = d$$

5.2.10 Calculation of Nutrient Retention Factor:

The nutrient Retention factor was determined as follows:

$$\textbf{Nutrient Retention \%} = \frac{\textbf{Content of nutrient / 100 g of food after cooking}}{\textbf{Content of nutrient / 100 g of food before cooking}} \times d$$

5.2.11 Analytical Quality Control

The term quality control is often used in only the narrowest sense — the monitoring of the performance of analytical methods (Büttner*et al.*, 1975) which refers to the accuracy and precision in the performance of the analytical method. But it must be mentioned that the quality control standards set by analytical chemists may be unnecessarily strict for most nutritional purposes; however, quality control is still vital to ensure that bias is not introduced (Greenfield and Southgate 2003).Reliability of laboratory measurements was assessed by determining the variance of a method in terms of its accuracy and precision.

5.2.12 Precision of analytical values

For each analytical method coefficient of variation (CV) was determined as an index of precision. CV was determined in a quantitative manner.

A composite mixture of the study samples were prepared by mixing and homogenising equal amounts of each sample. Proximate analysis of the composite sample was done by the methods described above with 6 estimations in a row. Standard deviation (SD) and coefficient of variation (CV) was calculated by the following equations:

Calculation

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{n-1}}$$

Where i ranges from 1 to n; ∑ is sum of all values from i =1 to n; $\bar{x}$ is mean

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

5.2.13 Accuracy of the analytical values:

Food samples are biometrics. So accuracy value of nutrient in foods is a difficult attribute to measure because of its unknown true value. The first stage is to analyze standard amounts of the pure analyze. Quality control (QC) materials usually are used with each batch of analysis. For the QC certified, reference, consensus or in-house material which has been developed for particular nutrients (Greenfield and Southgate 2003).

Standard reference materials (SRMs) are unique materials with a range of food matrices that have been produced by a national or regional organization such as the National Institute of Standards and Technology (NIST 2003) in the United States. SRMs are very expensive to produce and therefore too costly to use routinely and alternatives must often be used. In the absence of an SRM, a laboratory routinely performing certain types of determinations should provide itself with working standard materials (in-house standards) using similar approaches to that used to produce SRMs (Southgate 1995). The preferred materials of food matrices for in-house reference materials are common to the local food supply, e.g. soybean meal and fishmeal for ASEANFOODS (Puwastien, 2000).

Since SRMs were not achievable for the present study an in-house reference materials (IHRM) was used for each nutrient analysis. The IHRM prepared in our laboratory was Payesh, a very common food item in every households of Bangladesh. A large amount of Payesh was prepared with standard recipe followed by homogenization and drying. Dried samples were powdered with great care taken to achieve homogeneity, dispensed into small, sealed bottles and stored under conditions that prevent deterioration (desiccated at refrigerator).
Portion of this IHRM was used in each batch of analysis. Values were kept in a periodical chart. The accuracy of nutrient values of the foods analyzed in the present study was thus checked with this IHRM.

5.3 Recipe calculation for mineral and vitamins of HMRI using a *Recipe Calculation Program*

The minerals and vitamins content of HMRI is estimated by a recipe calculation program developed in our laboratory (www.infsrecipecal.com). The program used weight changes of ingredients during cooking and food processing into account by using yield factors, whereas changes in the nutrient content of ingredients are taken into account by using nutrient retention factors. Of the many recipe calculation programs, the *Mixed Recipe Calculation Method* has been used in this program. The summary steps of mixed recipe method are outlined in the Box 1.

Box 1: Summary of Mixed Recipe Method

Ingredient 1: NV*RF
Ingredient 2: NV*RF
Ingredient 3: NV*RF

Recipe: Sum of above*1/YF

5.3.1 Data compilation for standardized nutrient profile of HMRI by comparing with references values

To obtain a standardized food composition dataset for each of the studied HMRI, both analytical and recipe calculated data were combined and compared with regional and global food composition databases. For this purpose, the FAO/INFOODS Compilation Tool version 1.2.1, a food composition database management system in Excel (http://www.fao.org/infoods/infoods/software-tools/en/) was used.

5.3.2 Nutrient Density (ND) score of HMRI

Nutrient density refers to the amount of essential nutrients, i.e. protein, vitamins, minerals per energy unit (joule or kcal). The ND of each of each HMRI was determined according to the formula described below.

The nutrient densities for each essential nutrient were used to develop in a nutrient scoring scale of 1 to 8. The sum of total number for all nutrients was calculated. And the HMRI was then ranked in a Table from highest to lowest score obtained.

Calculation

All values are based on 100 g of food:

$$\textit{Nutrient Density} = \frac{\textit{Nutrient value (Protein/CHO/Fat/DF/Vitamin/Minerals) of each food}}{\textit{Energy [kcal] value of each food}} \times 100$$

5.3.3 Comparison of HMRI nutrient density with daily RDA of IYCF infants

The Recommended Dietary Allowances (RDA) refer to the recommended daily levels of nutrients to meet the needs of nearly all healthy individuals in a particular age and gender group. Compared ND of selected HMRI with daily RDA needs of 6-24 month children to find

6. Results

The findings of the study are described in three parts: Part I Sociodemogrphic features of the respondents, Part II Chemical analysis of proximate nutrients of the selected HMRI; Part III Recipe calculation for mineral and vitamins of HMRI using a *Recipe Calculation Program and* Data compilation for complete nutrient profile of HMRI by comparing with references values.

6.1 Sociodemogrphic features of the respondents

The sociodemogrphic features of the study respondents both from metropolitan Dhaka (Bangladesh) and metropolitan Juba (South Sudan) are presented in Table 6-7.

Table 6: Socio-Demographic features of Dhaka respondents

Characteristics	Frequency	Percentage (%)
Children Age (in Months)		
6-9	33	**33**
10-12	28	28
13-18	20	20
19-24	17	17
Mean+ SD	15±5.627	
Mothers Education		
<S.S.C	2	2
H.S.C	45	**45**
>H.S.C	38	38
Graduate	11	11
>Graduate	4	4
Total	100	
Mothers Occupation		
Student	3	3
Service	8	8
Housewife	89	**89**
Total	100	
Monthly Family Income (Tk)[a]		
5000-15000	51	51
>15000	49	49
Family size		
3-4	49	**49**
5-7	34	34
>7	17	17
Mean + SD	5+ 1.581	

[a]Taka (Tk): 1 USD=76 (at the time of data collection).

Table 6 shows that 61% of the study infants were between 6 to 12 months old. Majority of respondent mother are housewife and completed their secondary education. While majority of the respondent HH (49%) had small family sizes and their average income range was in between Tk. 5000-15000.

Table 7: Socio-Demographic features of Juba respondents

Characteristics	Frequency	Percentage (%)
Children Age (in Months)		
6-8	14	28
9-11	13	26
12-24	23	46
Mean± SD	16±5.507	
Mothers Education		
No education	10	18
< Primary 5	2	6
Completed Primary 5	18	36
Completed Secondary	16	32
education	4	8
>Graduate		
Total	50	
Monthly Family Income (SSP)[b]		
No income	14	28
<250	14	28
250-1000	14	28
>1000	8	16

[b] South Sudanese Pound (SSP): 1 USD=22 SSP (at the time of data collection).

Table 7 shows that 54% of the study infants were between 6 to 12 months old. Only 30% of the mothers have completed primary and secondary education. The income range of South Sudanese population was not stable due to frequent insurgency and high inflation rate. The income division shown in this Table was derived by comparing the relative income of the population from which the sample was drawn. Average per capita consumption in Southern Sudan is 100 Sudanese Pounds (SSP) per person per month (Southern Sudan Centre for Census, Statistics and Evaluation (SSCCSE, Juba, South Sudan, 2010) which is also an index of poor income of average South Sudanese people.

6.2 Findings of recipe survey

6.2.1 Selection of HMRI

Out 76 recipe cited by the study respondents, 27 HMRI were selected for standardization on basis of citation percentage. Table 8 shows the list of recipes from all HMRI cited by Bangladeshi respondents and Table 9 shows the similar list from study respondents of South Sudan

Table 8: Citation percentage of the standardized Bangladeshi HMRI

Serial No	Name of the Recipe	Citation percentage (CP)*
1	Milk Semai	14
2	Payesh	12
3	Sobji Khichuri	11
4	Noodles	10
5	Sooji Kheer	9
6	Boiled egg	7
7	Pitha	5
8	Khichiri	6
9	Egg fry	3
10	Masoor daler bora	2
11	Sooji	2
12	Maggi Soup	2
13	Luchi	2
14	Porota	2
15	Sabu	2
16	Puuding	2

* Total citation of all foods= 419; HMRI which has CP of > 2% are listed only.

Table 9: Citation percentage of the standardized South Sudanese HMRI

Serial No	Name of the Recipe	Citation percentage(CP)*
1	beans/bean soup	63
2	Greens/Dodo	59
3	Porridge	56
4	Meat/Meat soup	44
5	Irish potato	22
6	Lentils	16
7	Local foods	16
8	Milk	16
9	Fish Soup	13
10	Meat	6
11	Rice	16

* Total citation of all foods= 32; HMRI which has CP of > 6 % are listed only.

6.2.2 Processing and cooking of selected HMRI

Table 10- 18 shows the composition and cooking procedure of the HMRI which were selected randomly from the HMRI citation list because of the availability of recipe ingredients as well as easy cooking procedure.

Table 10: Payesh

Ingredients	Amount	Cooking Procedure
Rice Milk Water Sugar Raisin Cinnamon Cardamons	250 g 500 g 1000 g 300 g 2 g 0.5 g 0.5 g	1. Clean and wash rice well in a different pan. 2. Bring the milk to Boil in a pan; after milk boiled add water and let boil further for 8-10 minutes on medium heat. 3. Add the soaked rice, cinnamon, cardamons, raisin and mix well 4. Reduce heat to low and simmer until half of the milk remains in the pan and the rice is tender. 5. As the rice gets cooked add sugar, Keep on flame till the sugar melts 6. Keep stirring time to time throughout the process. 7. Let it be cool and serve it to your baby with Love.

Table 11: Sobji Khichuri

Ingredients	Amount	Cooking Procedure
Rice Red Lentil Sweet Pumpkin Malabar Spinash Potato Onion Soya bin Oil Green Chili Turmeric Salt Water	100 g 50 g 5 g 5 g 7 g 20 g 20 g 1 g 2 g 2 g 1000 g	1. Clean and wash dal and rice well. 2. Also clean and wash all the vegetables, potato, onion and chop into small pieces. 3. Now add all together dal, rice, water, all chop vegetables, onion, oil, green chili, turmeric and salt into a cooking pot. 4. And let them boil and simmer for about 20-30 minutes so they are appropriately cooked 5. Check after 10-15 minutes for everything is well- cooked (You should be able to mash them with a spoon). 6. Mash khichuri lightly with a spoon. 7. Vegetable Khichuri is ready. Take out the Vegetable Khichuri in a serving bowl and serve

Table 12: Sooji Kheer

Ingredients	Amount	Cooking Procedure
Sooji Sugar Milk Water	100 g 50 g 250 g 200 g	1. Dry roast the sooji in a clean dry pan till it turns golden brown. 2. Cook on low flame and keep stirring continuously otherwise the suji will burn. Keep aside. 3. When its look golden brown add milk, water and let it come to a boil. Lastly, add sugar 4. Mix well and let it be boiled till then it becomes thick 5. Let it be cool and serve it to your baby with Love.

Table 13: Milk-Semai

Ingredients	Amount	Cooking Procedure
Semai Milk Sugar Raisin Cinnamon Cardamon Water	200 g 250 g 250 g 4 g 0.5 g 0.5 g 900 g	1. Boil the milk in a deep pan, continue heated the milk until enough thick (like ½ of 1 lit). Keep hit very low or stop 2. Hitting the milk. 3. Now add water, sugar, cinnamon, cardamon with boiled milk and boil it again 10-12 minutes. 4. When milk and water boiled very well add semai and Keep hit very low or stop hitting the milk. 5. When semai and milk missed finely then add raisin (kichmish). 6. And you can serve it hot and cold both way depend on your test.

Table 14: Luchi

Ingredients	Amount	Cooking Procedure
Wheat Flour Oil Salt Water	250 g 100 g 4 g 200 g	1. Take the flour in a big bowl, salt and 2 tablespoon of oil 2. Mix the ingredients well to form a sandy mixture 3. Pour in half the water and knead the dough to almost dry 4. Then again pour the other half of water and knead well 5. If you feel the dough is not sticking to your palm, then it's ready 6. Divide the dough into small balls, dip half the balls in oil for lubrication and roll the balls to 4-5 inch diameter circles 7. Heat oil for frying in a deep wok till smoking hot 8. Reduce the flame and slide in the rolled out luchi 9. Press the luchi, while frying with the back of a slotted spatula, this helps in making the luchi fluffy. Take out of flame and place in a colander to let the luchi drain out the excess oil 10. Serve with any thick gravy curry (veg or non-veg)

Table 15: Masoor Daler Bora

Ingredients	Amount	Cooking Procedure
Lentils	100 g	1. Soak Masoor Dal in water for an hour. 2. Drain water and add the lentils, green chillies and water (as required) to a blender. Make a thick paste. 3. To the paste add salt, onion and coriander leaves. Mix well. 4. In a pan, heat oil and deep fry 5. reduce the flame 6. And you can serve it hot and cold both way depend on your test.
Onion	100 g	
Green chili	6 g	
Salt	3 g	
Coriander leaves	10 g	
soy oil	100 g	
Water	100 g	

Table 16: Noodles

Ingredients	Amount	Cooking Procedure
Maggi Noodles	62 g	1. Take a bowl and pour some water into it and starts heating process.
Egg	1 Pc	2. When the water starts to boiling, add noodles into it and boil up to 2-5 minutes. After 2-3 minutes add noodles masala.
Oil	10 g g	3. Transfer the cooked noodles into a plate.
Onion	20 g	4. Then take a pan, switch on the stove. Pour some oil into it. When the oil starts to heating,
Green Chili	1 Pc	5. Add onion and green chili into it and when onion color change add vegetables.
Maggi Masala	2 g	6. After some time when the vegetables color changes brown, add one egg with the vegetables and mix it well
Mixed Vegetable	1/2 Cup	7. When mixed done then add some water into it. Then also add some salt.
Water	400 g	8. Wait for 3-5 minutes. Then add prepared noodles into the above mixture and mix it well.

Table 17: Maggi Soup

Ingredients	Amount	Cooking Procedure
Maggi soup	1 Pack	1. Combine Maggi soup pack contents with 400mL of cold water in a saucepan.
Water	400mL	2. Stir until boiling; simmer for 5 minutes.
		3. Soup is ready. Take out the soup in a serving bowl and serve

Table 18: Bean Soup

Ingredients	Amount	Cooking Procedure
Dry beans	300 g	1. Clean your hands with soap and water; 2. Wash the beans with plenty of clean (running) water to wash to remove the soils particles and any other dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil beans; 4. Chop/cut the tomatoes, Onions, Rayco and pour it into the saucepan of the boiling water; 5. Add salt and oil to your taste and allow to boil for 2 hour; 6. Remove from fire and serve
Onions	20 g	
Tomatoes	100 g	
Rayco	2.5 g	
Oil	30 ml	
Salt	10 g	
Water	1.5-2.0 L	

6.3 Proximate analysis of selected recipes

To minimize cost of chemical analysis for all nutrients and to obtain a fresh cooking YF for each recipe, only proximate analysis of these HMRIs were done in our laboratory. All analysis of proximate nutrients was performed using AOAC methods as described in methods and materials section.

The results of HMRI chemical analysis is summarized in Table 19.

Table 19: Proximate nutrient profile of HMRI

Food Code	Bengali Name	English name	Cooking Yield* (%)	EDIBLE	ENERC* (kcal) kJ	WATER (g)	PROT (g)	FATCE (g)	CHOAVLDF (g)*	FIBTG or [FIBC] (g)	ASH (g)
			Yield factor	Edible portion coefficient	Energy	Water	Protein	Fat	Carbohydrate available	Total dietary fiber	Ash
1	Bean Soup	Bean Soup	**0.328**	**1**	**235.035**	**58**	**8.523**	**17.34**	**9.244**	**3.92**	**2.65**
2	Sooji Kheer	Semolina	**0.17**	**1**	**184.552**	**51.04**	**5.123**	**0.98**	**38.03**	**1.56**	**1**
3	Noodles	Noodles	**0.531**	**1**	**190.955**	**69.404**	**3.682**	**15.231**	**9.022**	**1.53**	**0.141**
4	Luchi	Deep-Fried Flatbread	**0.736**	**1**	**309.506**	**27.677**	**8.316**	**6.235**	**54.256**	**1.55**	**1.9665**
5	Payesh	Rice Pudding	**0.330**	**1**	**175.911**	**58.41**	**1.984**	**0.335**	**40.7**	**1.08**	**0.144**
6	Milk semai	Vermicelli Milk Pudding	**0.807**	**1**	**171.215**	**64.046**	**4.33**	**6.1373**	**24.1213**	**1.0849**	**0.2795**
7	Masoor Daler Bora	Lentil Fritter	**0.487**	**1**	**285.01**	**34.704**	**5.375**	**7.432**	**48.094**	**2.125**	**2.445**
8	Sobji i-Khichuri	mixed veg.khichuri	**0.390**	**1**	**190.16**	**54.25**	**5.805**	**3.92**	**31.604**	**2.622**	**1.795**
9	Maggi Soup	Maggi Soup	**0.551**	**1**	**36.7855**	**90.1824**	**0.5855**	**0.7683**	**6.7062**	**0.352**	**1.4056**

*Values are calculated as shown in methods and materials

6.4 Recipe calculation for mineral and vitamins using a *Recipe Calculation Program*

The minerals and vitamins content of the selected recipes were calculated by a web-based recipe calculation program developed in our laboratory (http://www.infsrecipecal.com). The key steps of the recipe calculation procedure have been elaborated in methodology section. Table 20 shows the mineral composition while Table 21 shows the vitamins content and composition of these recipes calculated by above mention recipe calculation program.

Table 20: HMRI minerals composition profile after compilation of analytical, calculated, and reference nutrients data

Food Code	Bengali Name	CA (mg)	FE (mg)	MG (mg)	P (mg)	K (mg)	NA (mg)	ZN (mg)	CU (mg)
		Calcium	Iron	Magnesium	Phosphorus	Potassium	Sodium	Zinc	Copper
1	Bean Soup	67	2.5	57	48	327.58	907	0.69	0.068
2	Sooji Kheer	115.94	0.321	18.756	114.601	170.577	15.462	0.766	0.05
3	Noodles	29.88	1.86	30.46	37.396	74.04	11.511	0.573	0.17
4	Luchi	4.8	1.224	21.633	50.904	76.245	233.035	0.565	0.07
5	Payesh	70.696	0.150	13.059	73.193	81.991	34.151	0.466	0.04
6	Milk Semai	43.4	0.6	7.71	39	61.486	21.302	0.22	0.129
7	Masoor Daler Bora	24.456	2.218	32	92	240.708	174.826	0.930	0.3
8	Sobji i-Khichuri	5.541	1.54	32.86	76	254.435	517.414	0.92	0.149
9	Maggi Soup						0.6		

Table 21: HMRI vitamins composition profile after compilation of analytical, calculated, and reference nutrients data

Food Code	Bengali Name	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
		Vitamin A	Retinol	Beta-carotene equivalents, or [beta-carotene]	Alpha-carotene	Beta-carotene	Cryptoxanthin, total	Vitamin D	Vitamin E, or [alpha-tocopherol]	Thiamin	Riboflavin	Niacin equivalents, or [Niacin]
1	Bean Soup	**42.8**		**514**					**3.31**	**0.056**	**0.0204**	**0.027**
2	Sooji Kheer	**37.018**	**35.847**	**16.365**				**0.08**	**0.1**	**0.03**	**0.09**	**1.05**
3	Noodles	**11.08**		**132.919**					**1.013**	**0.055**	**0.033**	**1.30**
4	Luchi								**2.421**	**0.034**	**0.019**	**1.452**
5	Payesh	**27.856**	**27.049**	**9.927**				**0.047**	**0.390**	**0.03**	**0.17**	**0.1635**
6	Milk Semai	**13.19**	**12.76**	**5.96**				**0.03**	**0.6**	**0.014**	**0.054**	**0.446**
7	Masoor Daler Bora	**5.872**		**69.618**				**0**	**5.222**	**0.254**	**0.08**	**2.12**
8	Sobji i-Khichuri	**8.21**		**98.13**				**0.003**	**0.716**	**0.1**	**0.038**	**1.641**
9	Maggi Soup											

Food Code	Bengali Name	NIA (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
		Niacin, preformed	Vitamin B 6	Folate	L-ascorbic acid	(g)	(g)	(g)			(g)	mg
1	Bean Soup		0.12	81.91	6.04							
2	Sooji Kheer		0.036	10	0.86	7.5	5.1	1.4	0.03		47.2	32.65
3	Noodles		0.077	9.275	0.87	0.005	0.007	0.006			0.6	46
4	Luchi		0.026									
5	Payesh		0.01	5.153	1.083	12.1				0.001	17.6	82.95
6	Milk Semai		0.011	2.67	0.4	0.002	1.500	0.400		0.032	0.079	19.6
7	Masoor Daler Bora		0.167	19.301	4.964				0.001	0		
8	Sobji i-Khichuri		0.06	10.7	0.1185	1.7	0.077	1				
9	Maggi Soup											

*Mineral and vitamins are calculated using food recipe calculator program and reference of recipe.

6.5 Nutrient Density (ND) of selected HMRI

Nutrient density refers to the amount of essential nutrients, i.e. protein, vitamins, minerals per energy unit (joule or kcal). The nutrient score of each HMRI was calculated as described in methods and material. The HMRI were arranged in order of highest to lowest position as shown in Table 22-26.

Table 22: Nutrient Density of HMRI for energy yielding nutrients

Nutrient Density	
Name of the Recipe	Protein (%)
Bean Soup	**3.626**
Sobji i-Khichuri	**3.052**
Sooji Kheer	**2.775**
Luchi	**2.686**
Milk Semai	**2.528**
Noodles	**1.928**
Masoor Daler Bora	**1.885**
Maggi Soup	**1.591**
Payesh	**1.127**

Nutrient Density	
Name of the Recipe	Fat (%)
Noodles	**7.976**
Bean Soup	**7.377**
Milk Semai	**3.584**
Masoor Daler Bora	**2.607**
Maggi Soup	**2.088**
Sobji i-Khichuri	**2.061**
Homemade Luchi	**2.015**
Sooji Kheer	**0.531**
Payesh	**0.19**

Nutrient Density	
Name of the Recipe	CHO (%)
Payesh	**23.136**
Sooji Kheer	**20.606**
Maggi Soup	**18.23**
Luchi	**17.530**
Masoor Daler Bora	**16.874**
Sobji i-Khichuri	**16.619**
Milk Semai	**14.088**
Noodles	**4.724**
Bean Soup	**3.933**

Nutrient Density	
Name of the Recipe	Dietary Fiber (%)
Bean Soup	**1.667**
Sobji i-Khichuri	**1.378**
Maggi Soup	**0.956**
Sooji Kheer	**0.845**
Noodles	**0.801**
Masoor Daler Bora	**0.745**
Milk Semai	**0.633**
Payesh	**0.613**
Luchi	**0.5**

Table 23: Nutrient Density of HMRI for essential Macro Minerals

Nutrient Density	
Name of the Recipe	Ca (%)
Sooji Kheer	**62.82**
Payesh	**40.188**
Bean Soup	**28.506**
Milk Semai	**25.348**
Noodles	**15.65**
Masoor Daler Bora	**8.58**
Sobji i-Khichuri	**2.913**
Luchi	**1.55**

Nutrient Density	
Name of the Recipe	Na (%)
Bean Soup	**385.9**
Sobji i-Khichuri	**272.094**
Luchi	**75.292**
Masoor Daler Bora	**61.340**
Payesh	**19.41**
Milk Semai	**12.442**
Sooji Kheer	**8.378**
Noodles	**6.028**

Nutrient Density	
Name of the Recipe	Mg (%)
Bean Soup	**24.25**
Sobji i-Khichuri	**17.28**
Noodles	**16.95**
Masoor Daler Bora	**11.227**
Sooji Kheer	**10.162**
Payesh	**7.423**
Luchi	**6.989**
Milk Semai	**4.503**

Nutrient Density	
Name of the Recipe	Phosphorus (%)
Sooji Kheer	**62.096**
Payesh	**41.607**
Sobji i-Khichuri	**39.966**
Masoor Daler Bora	**32.279**
Milk Semai	**22.778**
Bean Soup	**20.422**
Noodles	**19.583**
Luchi	**16.446**

Nutrient Density	
Name of the Recipe	K (%)
Bean Soup	**139.375**
Sobji i-Khichuri	**133.801**
Sooji Kheer	**92.427**
Masoor Daler Bora	**84.456**
Payesh	**46.609**
Noodles	**38.773**
Milk Semai	**35.911**
Luchi	**24.634**

Table 24: Nutrient Density of HMRI for essential Micro Minerals

Nutrient Density	
Name of the Recipe	Iron (%)
Bean Soup	**1.063**
Noodles	**0.974**
Sobji i-Khichuri	**0.809**
Masoor Daler Bora	**0.778**
Luchi	**0.395**
Sooji Kheer	**0.173**
Payesh	**0.085**
Milk Semai	**0.35**

Nutrient Density	
Name of the Recipe	Zn (%)
Sobji i-Khichuri	**0.483**
Sooji Kheer	**0.415**
Masoor Daler Bora	**0.326**
Noodles	**0.3**
Bean Soup	**0.293**
Payesh	**0.265**
Luchi	**0.182**
Milk Semai	**0.128**

Nutrient Density	
Name of the Recipe	Cu (%)
Masoor Daler Bora	**0.105**
Noodles	**0.09**
Sobji i-Khichuri	**0.078**
Milk Semai	**0.075**
Bean Soup	**0.028**
Sooji Kheer	**0.027**
Luchi	**0.02**
Payesh	**0.02**

Table 25: Nutrient Density of HMRI for essential Vitamin

Nutrient Density	
Name of the Recipe	Vitamin A (%)
Sooji Kheer	**20.058**
Bean Soup	**18.21**
Payesh	**15.835**
Milk Semai	**7.703**
Noodles	**5.802**
Sobji i-Khichuri	**4.317**
Masoor Daler Bora	**2.060**

Nutrient Density	
Name of the Recipe	Vitamin E (%)
Masoor Daler Bora	**1.832**
Bean Soup	**1.408**
Luchi	**0.782**
Noodles	**0.53**
Sobji i-Khichuri	**0.377**
Milk Semai	**0.35**
Sooji Kheer	**0.054**

Nutrient Density	
Name of the Recipe	L-ascorbic acid (%)
Payesh	**6.878**
Sooji Kheer	**4.063**
Bean Soup	**2.569**
Masoor Daler Bora	**1.742**
Payesh	**0.616**
Sooji Kheer	**0.465**
Milk Semai	**0.233**
Sobji i-Khichuri	**0.062**

Nutrient Density	
Name of the Recipe	Thiamin (%)
Masoor Daler Bora	**0.089**
Sobji i-Khichuri	**0.052**
Noodles	**0.028**
Bean Soup	**0.023**
Payesh	**0.017**
Sooji Kheer	**0.016**
Luchi	**0.01**
Milk Semai	**0.008**

Table 26: Nutrient Density of HMRI for essential Vitamin

Nutrient Density	
Name of the Recipe	Vitamin D (%)
Sooji Kheer	**0.043**
Payesh	**0.027**
Milk Semai	**0.017**
Sobji i-Khichuri	**0.001**

Nutrient Density	
Name of the Recipe	Folate (%)
Bean Soup	**34.85**
Masoor Daler Bora	**6.772**
Sobji i-Khichuri	**5.626**
Sooji Kheer	**5.418**
Noodles	**4.857**
Payesh	**2.929**
Milk Semai	**1.559**

Nutrient Density	
Name of the Recipe	Niacin (%)
Sobji i-Khichuri	**0.863**
Masoor Daler Bora	**0.743**
Noodles	**0.68**
Sooji Kheer	**0.568**
Luchi	**0.469**
Milk Semai	**0.26**
Payesh	**0.092**
Bean Soup	**0.011**

Each HMRI was than calculated for the overall ND score obtained as described in method in materials. Table 26 shows the rank of the HMRI on the basis of highest to lowest score. The data revels that Bean soup obtaining a total score 108 ranked in the top position of energy yielding nutrient density thus indicating that the composition of bean soup provides more calories from protein, fat, available carbohydrate and dietary fiber than rest of the HMRI analyzed.

Table 27: Overall average rank and highest/lowest ranks used to calculate nutrient density of HMRI

Rank	HMRI, Energy (Protein, fat, carbohydrate, diatery fiber) Yielding Nutrients (Highest, Lowest rank)	HMRI, Macro Minerals (Ca, Na, K, Mg, P) (Highest, Lowest rank)	HMRI, Micro minerals ((Highest, Lowest rank)	HMRI, Essential Vitamins (Vitamin A, E, Thiamin, Vitamin-D, Folate, Niacin) L-ascorbic acid(Highest, Lowest rank)
1	Bean Soup (8+7+0+8=23)	Bean Soup (6+8+8+8+3=33)	Sobji Khichuri (6+8+6=20)	Masoor daler bora (2+8+7+8+0+7+7=39)
2	Sobji Khichuri (7+3+3+7=20)	Sobji Khichuri (2+7+7+7+6=29)	Masoor daler bora (5+6+8=19)/Noodles (7+5+=197)	Bean Soup (7+7+8+5+0+8+1=36)/Sooji Kheer(8+2+5+3+8+5+5=36)
3	Sooji Kheer (6+1+7+5=19)	Sooji Kheer (8+2+6+4+8=28)	Bean Soup (8+4+4=16)	Sobji Khichuri (3+4+2+7+5+6+8=35)
4	Maggi Soup (1+4+6+6=17)	Payesh (7+4+4+3+7=25)	Sooji Kheer (3+7+3=13)	Noodles (4+5+4+6+0+4+6=29)
5	Noodles (3+8+1+4=16)	Masoor daler bora (3+5+5+5+5=23)	Luchi (4+2+2=8)	Payesh (6+0+6+4+7+3+2=28)
6	Milk Semai (4+6+2+2=14)/ Masoor daler bora (2+5+4+3=14)	Noodles (4+1+3+6+2=16)	Milk Semai (1+1+5=7)	Milk Semai (5+3+3+1+6+2+3=23)
7	Luchi (5+2+5+0=12)	Milk Semai (5+3+2+1+4=15)	Payesh (2+3+1=6)	Luchi (0+6+0+2+0+0+4=12)
8	Payesh (0+0+8+1=9)	Luchi (0+6+1+2+1=10)	Maggi soup (0)	Maggi soup (0)

Based on average ND score the HMRI ranked as follows (Box 2)

Box 2: HMRI ranked in Highest to lowest NDS	
Rank	HMRI
1	Bean Soup (108)
2	Sobji Khichuri (104)
3	Sooji Kheer (96)
4	Masoor daler bora (95)
5	Payesh (68)
6	Milk Semai (59)
7	Luchi (42)
8	Maggi Soup (18)

6.6 Comparison of HMRI nutrient density with daily RDA of IYCF infants and Young child

The Recommended Dietary Allowances (RDA) refer to the recommended daily levels of nutrients to meet the needs of nearly all healthy individuals in a particular age and gender group. The Table 28 showed the Daily RDA needs for 6-24 months children and Table 29 showed the comparison in between HMRI nutrient density with per serving RDA needs.

Table 28: Daily RDA for 6 to 24 month children

Nutrients	Age of child	Requirements
Energy	6-8 month	600 kcal/day
	9-11 month	700 kcal/day
	12-24 month	900 kcal/day
Fats/Oil	6-8 month	33.3 g/day
	9-11 month	38.9 g/day
	12-24 month	50 g/day
Protein	6-8 month	1.65 g/kg bdwt
	9-11 month	1.50 g/kg bdwt
	12-24 month	1.20 g/kg bdwt
CHO	6-8 month	74 g/day
	9-11 month	87.5 g/day
	12-24 month	112.5 g/day
Salt	6-8 month	1 g/day
	9-11 month	1 g/day
	12-24 month	2 g/day
Moisture/Fluid	6-8 month	800 ml
	9-11 month	1300 ml
	12-24 month	1300 ml
Dietary Fiber	24-59 month	15 g/day

Table 29: Relation in between HMRI content nutrients and daily RDA needs in per serving out of 3-4 meal for 6 to 24 month children

Nutrients	Daily RDA needs in per serving meal for 6 to 11 month children	Daily RDA needs in per serving meal for 12to 24 month children	Sobji-Khichuri ND in per serving (%)	Masoor Daler Bora ND in per serving (%)	Milk Semai ND in per serving (%)	Payesh ND in per serving (%)	Luchi ND in per serving (%)	Sooji Kheer ND in per serving (%)	Noodles ND in per serving (%)	Maggi Soup ND in per serving (%)	Bean Soup ND in per serving (%)
Energy (kcal/day)	200	225	65-90	100	46-71	50-75	100	60-85	66-95	40	100
Fat (g/day)	11	12.5	91-93	95-96	93-95	0	94-95	0	100	20	100
Protein (g/kg/day)	4.5	3.25	100	100	99-100	98	100	100	99-100	10	100
Carbohydrate (g/day)	25	28.25	100	100	96-99	100	100	100	80-84	40	80-84

Table 29 shows comparison with per serving nutrient densities of HMRI and RDA for the infants and young children. Among all HMRIs analyzed, Bean soup, *Sobji khichuri*, Masoor daler bora, Luchi, noodles can fulfills the dietary requirements up to 90-100%.

7. Discussion

Food composition data that are most urgently needed are the concentrations of nutrients in foods and dishes that have been prepared for consumption by customary procedures (Hepburn, 1982; Beecher and Vanderslice, 1984; Greenfield and Southgate, 1992). This need is especially urgent since much of the currently available analytical data were obtained from analyses of raw foods and food commodities.

Food composition data on recipes that we usually consume are scantly. The recently published "Food Composition Table for Bangladesh" contained nutrient composition of few commonly consumed recipes that had been contributed from our laboratory. These recipes, however, are daily intake recipes for adult populations. The recipes prepared for infants are rarely analyzed and reported. **The present study was undertaken to fulfill this gap by analyzing some frequently used recipes for the infant and young children feeding practices.**

In order to analyze these recipes, homemade recipes for the infants (HMRI) were given priorities over commercially available foods and food supplements designated for the children. Though commercialization of the food intake patters is rising in Bangladesh, majority of our population are still accustomed to take homemade foods. The middle-income rural as well as urban families still heavily rely on homemade family foods for their infants and young children. Therefore, a survey among mothers of urban middle-income families were conducted for recipes they used to prepare for their infants. The collected recipes were subjected to proximate analysis and estimation of minerals and vitamins by recipe calculation method. For geographical comparisons, similar kinds of foods were collected from South Sudan and analyzed similar ways.

Upon standardization with a cut-off point of minimum citations of an ingredient, 27 recipes were identified that were daily or frequently prepared by the respondent families from both of the geographical regions. About 70% of the studied households were found to prepare these HMRIs for their babies regularly. A total of 8 HMRIs from Bangladesh and 1 from South Sudan were selected for chemical analysis and recipe

calculation to obtain a complete food composition profile. One South Sudanese recipe was selected for preparation because of the in availability of ingredients in Bangladeshi market and rest of the selected recipes were not prepared for these reason.

The findings shows that Bean soup contains highest ND score 108 while Sobji khichuri was found to fulfill the majority of energy (100%), protein (90%) and fat (100%) requirements of the infants as per RDA for 6-24 month children. Bean soup contains less solid portion 40% than Sobji khichuri (46%) which leads Sobji khichuri to contain higher amount of protein, fat, and carbohydrate per 100g of solid portion. On the other hand, Bean soup contained higher density of both energy yielding nutrients, minerals, and vitamins thereby giving it to contain high ND score. Rest of the recipes analyzed showed relatively lower ND score and RDA fulfillment capacity then these two foods.

The findings of this study, therefore provides a much needed recipe composition data for a nutritious food for the IYCF practices to maintain proper growth and development. Moreover, mothers of the infant and young children can make these recipes more nutritious by value addition with other nutrient rich components.

Bean soup which showed high ND score is a South Sudanese recipe. It is not accustom to our IYCF practices in our society. Therefore, our IYCF practice can be customized by introducing bean soup and similar kind of recipes from other geographical region.

A further study is needed to analyze rest of the HMRIs identified and standardized in this study.

8. Conclusion and Recommendation

The findings suggested that the HMRIs studied are relatively more nutritious foods to infants and young children. Since homemade recipes are fresh and more nutritious than commercial foods, mothers should prefer this type of foods in their IYCF for better growth and development of their children.

The findings of this study may be incorporated in child feeding manuals because they are not only use to cook but also full of nutrients.

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10. Appendix

Appendix-1: Questionnaire of Survey in Bangladesh

Interview Date:

Time:

CONSENT FORM

Hello. My name is _____. I am conducting a survey in this community for assessment of nutritional status of 6 month to 2 years children to know the needs for sustainability. We would very much appreciate your participation in this survey.

I would also like to ask you about foods which are usually cook for your child. This information will help to find out the gap. The survey usually takes between 30 and 45 minutes to complete. Your answers will be kept strictly confidential and will not be shown to other persons and we will not link your name to any answers.

We cannot provide you with any direct benefits for your household. Participation is voluntary and you can choose not to answer any individual question you find very personal or all of the questions. However, we hope that you will participate in this survey since your views are important.

At this time, do you want to ask me anything about the survey?

(After answering any questions get verbal consent).

YES ⟶

NO ⟶

1. Mothers Name:

2. Age of mothers (tick the right answer):
    1. 15-20 years
    2. 21-30 years
    3. >30 years
    4. Don't know

3. Level of mothers education(tick the right answer):
    1. No education
    2. <S.S.C
    3. H.S.C
    4. >H.S.C
    5. Graduate

    6. > Graduate
4. Monthly family income(tick the right answer):
    1. 5000-15,000
    2. >15,000
    3. Don't know
    4. Refuse to answer

5. Name of the Child:

6. Sex (tick the right answer):

    1. Male
    2. Female

7. Age of the child(tick the right answer):

    1. 6 month to 9 month
    2. 10 month to 12 month
    3. 13 month to 18 month
    4. 19 month to 24 month

8. Number of siblings:

9. How often he/she felt sick in next six month:

10. What kinds of foods usually take your child in a day:

11. Tell me 5 foods name and recipe which usually take in a day:

Food name	Ingredients	Amounts(g/ml)	Cooking Process
1.			
2.			
3.			

Food name	Ingredients	Amounts(g/ml)	Cooking Process
4.			
5.			

Appendix-2: Questionnaire of Survey in South Sudan

Interview Date:

Time:

Name of the county:

Name of the Payam:

Name of the Boma:

House hold name:

CONSENT FORM

Hello. My name is _____. I am conducting a survey in this community for assessment of nutritional status of 6 month to 2 years children to know the needs for sustainability. We would very much appreciate your participation in this survey.

I would also like to ask you about foods which are usually cook for your child. This information will help to find out the gap so we can take better project in this community. The survey usually takes between 30 and 45 minutes to complete. Your answers will be kept strictly confidential and will not be shown to other persons and we will not link your name to any answers.

We cannot provide you with any direct benefits for your household. Participation is voluntary and you can choose not to answer any individual question you find very personal or all of the questions. However, we hope that you will participate in this survey since your views are important.

At this time, do you want to ask me anything about the survey?

(After answering any questions get verbal consent).

YES ⟶

NO ⟶

12. Mothers Name:

13. Age of mothers (tick the right answer):
    5. 15 years
    6. 16-20 years
    7. 21-25 years
    8. 26-30 years
    9. 30-35 years
    10. 36-40 years
    11. >40 years

12. Don't know

14. Level of mothers education(tick the right answer):
    7. No education
    8. Less than primary
    9. Less than P5
    10. Completed P5
    11. Completed S1 – S3
    12. Diploma or Certificate
    13. University Degree (BA/BSc)
    14. Masters [15]; PhD
    15. Don't Know
15. Monthly income(tick the right answer):
    5. Less than SSP 250
    6. SSP 251 to SSP 500
    7. SSP 501 to SSP 999
    8. SSP 1,000 to SSP 1,499
    9. SSP 1,500 to SSP 1,999
    10. More than SSP 2,000
    11. Don't know
    12. Refuse to answer

16. Name of the Child:

17. What is your tribe (tick the right answer):
    1. Specify tribe name_____
    2. Don't know
    3. Refuse to answer

18. What is your religion (tick the right answer):
    1. Christian
    2. Muslim
    3. Animist / traditional
    4. Other (specify) _____
    5. Don't know
    6. Refuse to answer

19. Sex (tick the right answer):

    3. Male
    4. Female

20. Age of the child(tick the right answer):

    5. 6 month to 8 month
    6. 9 month to 11 month
    7. 12 month to 24 month

21. Number of siblings:

22. How often he/she felt sick in next six month:

23. What kinds of foods usually take your child in a day:

24. Tell me 3 foods name and recipe which usually take in a day:

Food name	Ingredients	Amounts(g/ml)	Cooking Process
1			
2			

Food name	Ingredients	Amounts(g/ml)	Cooking Process
3			

Appendix-3: List of the classified Bangladeshi HMRI recipe

Category	Name of the recipe	Number of variety
1.Most used HMRI	Milk Semai	58
	Payesh	49
	Sobji Khichuri	46
	Noodles	43
	Sooji Kheer	38
	Boiled Egg	31
	Pitha	23
	Khichuri	25
	Fried Egg	13
	Masoor Daler Bora	8
	Suji	9
	Soup	7
	Luchi	6
	Porota	6
	Sabu	6
	Pudding	5
	Potato Chipes	5
	Fried Chicken	5
	French Fry	4
2. Less used HMRI	Fruit Juice	3
	Egg Sooji	3
	Rice Gura	2
	Chicken soup	1
	Fried Rice	1
	Gajor Halua	1
	Halim	1
	Jau Vat	1
	Khiir	1
	Egg Pitha	1
	Egg Milk Sooji	1
	Egg Chop	1
	Pakora	1
	Paya Soup	1
	Soojir Halua	1
	Singara	1
	Sooji Ruti	1
	Sooji-egg vaji	1

Category	Name of the recipe	Number of variety
	Vegetable Ball	1
	Vegetable Polau	1
	Vegetable Pitha	1
	Biriany	1
	Chicken Roll	1
	Cake	1
3.Uncommon HMRI	Milk egg	3

Appendix-4: List of South Sudanese HMRI

Serial Number	Name of the Recipes	Number of variety
1	Beans/bean soup	20
2	Greens/Dodo	19
3	Porridge	18
4	Meat/Meat soup	14
5	Irish potato	7
6	Lentils	5
7	Local foods	5
8	Milk	5
9	Fish Soup	4
10	Meat	2
11	Rice	5
12	Rice Soup	1
13	Akok (Local Dinka food)	1
14	Dry meat	1
15	egg	1
16	Fish(dry)	1
17	fish/meat	1
18	Fish/meat/milk	1
19	greens/lentils	1
20	Jampala(greens+cow	1

Serial Number	Name of the Recipes	Number of variety
	peas)	
21	Juice	1
22	Kejje (small fish)	1
23	Kisra	1
24	Local porsho,walwal	1
25	Maize flour	1
26	Meat/ fish	1
27	Soup	1
28	tomatoes	1
29	Walwal (Local Dinka food)	1

Appendix-5: Process and Cooking of some selected HMRI

5.1 Pudding

Ingredients	Amount	Cooking Procedure
Egg	3	1. Beat together eggs, milk, and sugar essence in a bowl until sugar dissolves.
Sugar	94	2. Put a flameproof baking mold on stove and add sugar for caramel to it.
Milk	250	3. Let it cook gently until the sugar melts and turn golden. And pour the pudding mixture on the golden caramel.
		4. Put the pudding dish, in a pan of water, in a pre-heated oven at 350 f for 45 minutes.
		5. Take it out of the oven and let it cool at room temperature.
		6. You can chill it in the refrigerator before serving or serve warm.
		7. For Serving: Carefully run a butter knife around the egg pudding, place a platter over the pudding
		8. Mold and crumbs over it and serve. Carefully turn it upside down. Sprinkle bread

5.2 Greens (Dodo)

Ingredients	Amount	Cooking Procedure
Greens/Local vegetables	300 g	1. Wash your hands with soap and clean (running);
Onion	40 g	2. Wash the Greens/Local vegetables with plenty of clean (running) water to wash to remove the soils particles and any other dirty substances;
Tomatoes	200 g	3. Allow time for water to drip off, DONOT squeeze the vegetables;
Salt	2.5 g	4. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); Chop/cut the onion, tomatoes and add local Magadi pour it into the saucepan of the boiling water;
Oil	3 ml	5. Add salt to your taste and allow to boil for 30 minutes;
Peanut Paste	15 g	6. Add ground nut or peanut paste and continue cooking for another 5 minutes; Remove from fire and serve.
Local Magadi	2.5 g	
Water	400 g	

5.3 Meat/ Meat Soup

Ingredients	Amount	Cooking Procedure
Beaf Meat	250 g	1. Wash your hands with soap and clean (running); 2. Wash the Beaf meat with plenty of clean (running) water to wash to remove dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); 4. Chop/cut the onion, tomatoes, rayco and pour it into the saucepan of the boiling water; Add salt, oil to your taste and allow to boil for 60 minutes; 5. Remove from fire and serve
Onion	20 g	
Tomatoes	100 g	
Oil	15 ml	
Rayco	10 g	
Salt	1.25 g	
Water	500 g	

5.4 Irish Potatoes/ Potatoes

Ingredients	Amount	Cooking Procedure
Potatoes	4 pc	1. Wash your hands with soap and clean (running); 2. Wash the Potatoes with plenty of clean (running) water to wash to remove dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); 4. Chop/cut the onion, tomatoes, and pour it into the saucepan of the boiling water; Add salt, oil to your taste and allow to boil for 30 minutes; Remove from fire and serve.
Onion	20 gm	
Oil	30 ml	
Tomatoes	100 g	
Salt	2.5 g	
Water	500 ml	

5.5 Lentils

Ingredients	Amount	Cooking Procedure
Lentils	300 g	1. Wash your hands with soap and clean (running); 2. Wash the Potatoes with plenty of clean (running) water to wash to remove dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); 4. Chop/cut the onion, tomatoes, and pour it into the saucepan of the boiling water; 5. Add salt, oil to your taste and allow to boil for 30 minutes; 6. Remove from fire and serve
Oil	10-15 ml	
Onion	20 g	
Tomatoes	100 g	
Salt	2.5 g	
Water	600-700 ml	

5.6 Fish Soup

Ingredients	Amount	Cooking Procedure
Fish	2 pc	1. Wash your hands with soap and clean (running); 2. Wash the Fish with plenty of clean (running) water to wash to remove dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); 4. Chop/cut the onion, tomatoes, rayco and pour it into the saucepan of the boiling water; 5. Add salt, oil to your taste and allow to boil for 30 minutes; 6. Remove from fire and serve
Onions	20 g	
Oil	15 ml	
Rayco	10 g	
Salt	10 g	
Water	400-500 ml	

5.7 Rice

Ingredients	Amount	Cooking Procedure
Rice Oil Salt Water	300 g 30 ml 2.5 g 600-700 ml	1. Wash your hands with soap and clean (running); 2. Wash the Rice with plenty of clean (running) water to wash to remove dirty substances; 3. Set fire and put clean water in a saucepan/pot, put on the fire and bring to boil (until big bubbles are formed); 4. Add salt and Oil to your taste and allow to boil for 30 minutes; 5. Remove from fire and serve

5.8 Milk egg

Ingredients	Amount	Cooking Procedure
Milk Egg	125 ml 1 pc	1. Take a bowl and pour milk into it and starts heating process. 2. It will take 5-7 minutes milk starts to boiling. 3. Take another bowl and break one egg into a bowl. Mix well until the color and texture are uniform throughout. 4. When 1/3 of the milk remains add texture egg and mix well 5. Reduce heat to low and simmer until half of the milk remains in the pan and the egg texture mixed well. 6. Keep stirring time to time throughout the process. 7. Let it be cool and serve it to your baby with Love.

5.9 Porridge

Ingredients	Amount	Cooking Procedure
Maize Flour	300 g	1. Wash your hands with soap and clean (running) water 2. Measure and pour 2 cups (400ml each) of clean water into a clean sauce pan 3. Measure and pour 300g of maize flour into a clean bowl/plate 4. Add 1 cup (200ml) of cold water into flour in the bowl/plate and mix to form a paste 5. Add the paste into the boiling water and continue stirring to form gruel. Cook for at least 10 minutes 6. Add 1 cup (200ml) of fresh goat's or cow's milk 7. During the last 2 minutes, add the 2 table spoonful of groundnut/sesames paste, sugar, oil and a pinch of salt. Stir until well mixed 8. Remove it from fire, cool slightly and serve;
Sugar	15 g	
Salt	0.25 g	
Oil	10 ml	
Milk	200 ml	
Peanut Paste	30-45 g	
Water	500 ml	

Appendix-6:

Table 6.1 Proximate composition of HMRI from others sources used for comparison

Food Code	Food Name in Bengali	Source	ENERC (kcal) kJ	WATER (g)	PROT (g)	FATCE (g)	CHOAVLDF (g)	FIBTG (g)	ASH (g)
			Energy	Water	Protein	Fat	Carbohydrate available	Total dietary fibre	Ash
1	Bean Soup	https://www.fatsecret.com/calories-nutrition/generic/bean-soup	137		6.58	4	19.23	8.6	
2	Sooji Kheer	http://www.myfitnesspal.com/food/calories/homemade-suji-kheer-400ml-milk-20g-suji-304068249	605.4		16.3	22	69	2.4	
2	Sooji Kheer	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=3246697	208		8	7	58	1	
3	Noodles	https://www.fatsecret.com/calories-nutrition/generic/noodles-cooked	219		7.22	3.3	40.02	1.9	
3	Noodles	https://www.caloriecount.com/calories-noodles-egg-i20310	221		7.3	3.3	40.3	1.9	
4	Luchi	http://www.myfitnesspal.com/food/calories/homemade-luchi-bengali-deep-fried-flatbread-9138775	140		0	10	0	0	
4	Luchi	https://www.caloriecount.com/luchi-recipe-r1576870	32		0.6	1.1	4.8	0.2	
4	Luchi	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=843024	140			10			
5	Payesh	https://www.caloriecount.com/chaler-payesh-recipe-r1416724	2643		69.1	66.8	450.6	8.1	
5	Payesh	http://www.myfitnesspal.com/food/calories/nikhhuthi-payesh-payesh-rice-and-milk-53372196	305		0	5	35	15	
5	Payesh	http://nutrifood.info/recipe-of-payesh/	1705		34.4	52	198.3		

Table 6.1 Proximate composition of HMRI from others sources used for comparison

Food Code	Food Name in Bengali	Source	ENERC (kcal) kJ	WATER (g)	PROT (g)	FATCE (g)	CHOAVLDF (g)	FIBTG (g)	ASH (g)
5	Payesh	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=328325	234.4		11.4	11.4	38.9	0.9	
6	Milk Semai	https://tanusreeroy.wordpress.com/2014/06/25/semai-er-payesh-vermicelli-milk-pudding-vermicelli-kheer/	228.8		8.6	3.7	41	1.2	
6	Milk Semai	http://www.fatsecret.com/calories-nutrition/generic/vermicelli-cooked?portionid=342724	220		8.07	1.2	42.95	2.5	
7	Masoor Daler Bora	Nutrient Composition of Some Cereals and Pulses Based Recipes of Assam, India(J. Hum. Ecol., 17(4): 237-246 (2005)	211	53	9	5.4	31.6	0.2	
7	Masoor Daler Bora	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=2208443	9.5		1.1	0	2.3	1.2	
7	Masoor Daler Bora	http://www.cookspiration.com/recipe.aspx?perma=rulQ2sHzwn4&g=7	60		2	3.5	6	2	
7	Masoor Daler Bora	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=2478608	173		16.27	3.5	30.47	15.2	
7	Masoor Daler Bora	http://www.canadianliving.com/food/article/crispy-lentil-fritters	165		4.5	13	10.5	2.5	
8	Sobji-Khichuri	http://www.myfitnesspal.com/food/calories/homemade-vegetable-khichdi-w-white-rice-259194137	336		8	16	40	5	
8	Sobji-Khichuri	https://recipes.sparkpeople.com/recipecalories.asp?recipe=93961	264.3		7.8	13	29.8	4.8	
9	Maggi Soup	https://www.maggime.com/maggi-range/maggi-soups/vegetable-soup/english/		41		0.8	0.3	8.7	1.1

Table 6.2 Mineral composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	CA (mg)	FE (mg)	MG (mg)	P (mg)	K (mg)	NA (mg)	ZN (mg)	CU (mg)
			Calcium	Iron	Magnesium	Phosphorus	Potassium	Sodium	Zinc	Copper
1	Bean Soup	https://www.fatsecret.com/calories-nutrition/generic/bean-soup					357	918		
1	Bean Soup	http://www.infsrecipecal.com (with analytical YF)	151.67	5.71	128.8	107.8	702	62.2	1.57	0.15
2	Sooji Kheer	http://www.myfitnespal.com/food/calories/homemade-suji-kheer-400ml-milk-20g-suji-304068249	0.48	0.04	0.07	0.05	70.2	153.7	0.02	0.05
2	Sooji Kheer	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=3246697		0.02				81		
3	Noodles	https://www.fatsecret.com/calories-nutrition/generic/noodles-cooked	0.02	0.13			61	378		
3	Noodles	https://www.calorieccount.com/calories-noodles-egg-i20310	0.02	0.13			60.8	264		
4	Luchi	http://www.myfitnespal.com/food/calories/homemade-luchi-bengali-deep-fried-flatbread-9138775		0.02			7	29		

Table 6.2 Mineral composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	CA (mg)	FE (mg)	MG (mg)	P (mg)	K (mg)	NA (mg)	ZN (mg)	CU (mg)
4	Luchi	https://www.calorieccount.com/luchi-recipe-r1576870								
4	Luchi	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=843024								
4	Luchi	http://www.infsrecipecal.com (with analytical YF)	33.1	7.05	149	350	525	1604.6	3.89	0.48
5	Payesh	https://www.caloriecount.com/chaler-payesh-recipe-r1416724	1.82	0.58			2836	599		
5	Payesh	http://www.myfitnesspal.com/food/calories/nikhhuthi-payesh-payesh-rice-and-milk-53372196	0	0			0	8		
5	Payesh	http://nutrifood.info/recipe-of-payesh/	197	16.86						
5	Payesh	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=328325	0.34	0.08			86.4	304.3	0.02	0.01
6	Milk Semai	https://tanusreeroy.wordpress.com/2014/06/25/semai-er-payesh-vermicelli-milk-pudding-vermicelli-kheer/					225.3	53.4		

Table 6.2 Mineral composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	CA (mg)	FE (mg)	MG (mg)	P (mg)	K (mg)	NA (mg)	ZN (mg)	CU (mg)
6	Milk Semai	http://www.fatsecret.com/calories-nutrition/generic/vermicelli-cooked?portionid=342724	0.01	0.10			63	326		
7	Masoor Daler Bora	Nutrient Composition of Some Cereals and Pulses Based Recipes of Assam, India(J. Hum. Ecol., 17(4): 237-246 (2005)	33	1.4						
7	Masoor Daler Bora	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=2208443	0.00	0.02	0.00		39.1	0.00	0.00	
7	Masoor Daler Bora	http://www.cookspiration.com/recipe.aspx?perma=rulQ2sHzwn4&g=7								
7	Masoor Daler Bora	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=2478608	0.29	3.45			388	1		
7	Masoor Daler Bora	http://www.canadianliving.com/food/article/crispy-lentil-fritters					159	100		

Table 6.2 Mineral composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	CA (mg)	FE (mg)	MG (mg)	P (mg)	K (mg)	NA (mg)	ZN (mg)	CU (mg)
8	Sobji-Khichuri	http://www.myfitnesspal.com/food/calories/homemade-vegetable-khichdi-w-white-rice-259194137	0.05				356	620		
8	Sobji-Khichuri	https://recipes.sparkpeople.com/recipecalories.asp?recipe=93961	0.05	0.20	0.19		356	121.6	0.07	0.09
9	Maggi Soup	https://www.maggime.com/maggi-range/maggi-soups/vegetable-soup/english/						0.6		
9	Maggi Soup	Proximat nutrient value (lab analysis)								

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
			Vitamin A	Retinol	Beta-carotene equivalents, or [beta-carotene]	Alpha-carotene	Beta-carotene	Cryptoxanthin, total	Vitamin D	Vitamin E, or [alpha-tocopherol]	Thiamin	Riboflavin	Niacin equivalents, or [Niacin]
1	Bean Soup	https://www.fatsecret.com/calories-nutrition/generic/bean-soup											
1	Bean Soup	http://www.infsrecipecal.com (with analytical YF)	96		1153.6					7.43	0.13	0.05	0.06
2	Sooji Kheer	http://www.myfitnesspal.com/food/calories/home made-suji-kheer-400ml-milk-20g-suji-304068249	0.14							0.12	0.02	0.05	0.02

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
2	Sooji Kheer	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=3246697	0.04										
3	Noodles	https://www.fatsecret.com/calories-nutrition/generic/noodles-cooked	0.01										
3	Noodles	https://www.caloriecount.com/calories-noodles-egg-i20310	0.01										
4	Luchi	http://www.myfitnesspal.com/food/calories/homemade-luchi-bengali-deep-fried-flatbread-9138775											
4	Luchi	https://www.caloriecount.com/luchi-											

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
		recipe-r1576870											
4	Luchi	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=843024											
4	Luchi	http://www.infsrecipecal.com (with analytical YF)								16.21	0.23	0.15	10
5	Payesh	https://www.caloriecount.com/chaler-payesh-recipe-r1416724	0.30										
5	Payesh	http://www.myfitnesspal.com/food/calories/nikhhuthi-payesh-payesh-rice-and-milk-53372196	0.16										

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
5	Payesh	http://nutrifood.info/recipe-of-payesh/											
5	Payesh	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=328325	0.07						0.25	0.03	0.00	0.00	0.03
6	Milk Semai	https://tanusreeroy.wordpress.com/2014/06/25/semai-er-payesh-vermicelli-milk-pudding-vermicelli-kheer/											
6	Milk Semai	http://www.fatsecret.com/calories-nutrition/generic/vermicelli-cooked?porti											

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
		onid=342724											
7	Masoor Daler Bora	Nutrient Composition of Some Cereals and Pulses Based Recipes of Assam, India(J. Hum. Ecol., 17(4): 237-246 (2005)											
7	Masoor Daler Bora	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=2208443	0.00						0	0.00	0.00	0.00	0.00
7	Masoor Daler Bora	http://www.cookspiration.com/recipe.aspx?perma=rulQ2sHzw											

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
		n4&g=7											
7	Masoor Daler Bora	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=2478608	0.01										
7	Masoor Daler Bora	http://www.canadianliving.com/food/article/crispy-lentil-fritters											
8	Sobji-Khichuri	http://www.myfitnesspal.com/food/calories/homemade-vegetable-khichdi-w-white-rice-259194137	0.05										
8	Sobji-Khichuri	https://recipes.sparkpeople.com/recipecalories.asp	0.05						0.00	0.09	0.08	0.03	5.7

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	Food name in Bengali	Source	VITA_RAE (mcg)	RETOL (mcg)	CARTBEQ or [CARTB] (mcg)	CARTA (mcg)	CARTB (mcg)	CRYPX (mcg)	VITD (mcg)	VITE, or [TOCPHA] (mg)	THIA (mg)	RIBF (mg)	NIAEQ, or [NIA] (mg)
		?recipe=93961											
9	Maggi Soup	https://www.maggime.com/maggi-range/maggi-soups/vegetable-soup/english/											
9	Maggi Soup	Proximat nutrient value (lab analysis)											

Table 6.3 Vitamin composition of HMRI from others sources used for comparison

Food Code	**Food name in Bengali**	**Source**	**NIA (mg)**	**NIATRP (mg)**	**VITB6A (mg)**	**FOL (mcg)**	**ASCL (mg)**	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
			Niacin, preformed	Niacin equivalents from tryptophan	Vitamin B 6	Folate	L-ascorbic acid	(g)	(g)	(g)			(g)	mg
1	Bean Soup	https://www.fatsecret.com/calories-nutrition/generic/bean-soup												
1	Bean Soup	http://www.infsrecipecal.com (with analytical YF)			0.27	183.8	13.56							
2	Sooji Kheer	http://www.myfitnesspal.com/food/calories/homemade-suji-kheer-400ml-milk-20g-suji-304068249				0.01	0.01	11	5.1	1.4	0.00		69.4	45.3
2	Sooji Kheer	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=3246697						4					25	20

Food Code	Food name in Bengali	Source	NIA (mg)	NIATRP (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
3	Noodles	https://www.fatsecret.com/calories-nutrition/generic/noodles-cooked												
3	Noodles	https://www.caloriecount.com/calories-noodles-egg-i20310						0.01	0.01	0.01			0.6	46
4	Luchi	http://www.myfitnesspal.com/food/calories/homemade-luchi-bengali-deep-fried-flatbread-9138775												
4	Luchi	https://www.caloriecount.com/luchi-recipe-r1576870												
4	Luchi	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=843024												

Food Code	Food name in Bengali	Source	NIA (mg)	NIATRP (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
4	Luchi	http://www.infsrecipecal.com (with analytical YF)			0.11	50								
5	Payesh	https://www.caloriecount.com/chaler-payesh-recipe-r1416724					0.01	29						146
5	Payesh	http://www.myfitnesspal.com/food/calories/nikhhuthi-payesh-payesh-rice-and-milk-53372196						2						1
5	Payesh	http://nutrifood.info/recipe-of-payesh/												
5	Payesh	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=328325				0.03	0.05	5.3				0.00	17.6	19.9

Food Code	Food name in Bengali	Source	NIA (mg)	NIATRP (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
6	Milk Semai	https://tanusreeroy.wordpress.com/2014/06/25/semai-er-payesh-vermicelli-milk-pudding-vermicelli-kheer/					0.02		1.5	0.4		0.03	0.08	19.6
6	Milk Semai	http://www.fatsecret.com/calories-nutrition/generic/vermicelli-cooked?portionid=342724						0.00	0.00	0.00				
7	Masoor Daler Bora	Nutrient Composition of Some Cereals and Pulses Based Recipes of Assam, India(J. Hum. Ecol., 17(4): 237-246 (2005)												

Food Code	Food name in Bengali	Source	NIA (mg)	NIATRP (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
7	Masoor Daler Bora	https://recipes.sparkpeople.com/recipe-calories.asp?recipe=2208443				0.00					0.00	0.00		
7	Masoor Daler Bora	http://www.cookspiration.com/recipe.aspx?perma=rulQ2sHzwn4&g=7												
7	Masoor Daler Bora	http://www.fatsecret.com/Diary.aspx?pa=fjrd&rid=2478608					0.59							
7	Masoor Daler Bora	http://www.canadianliving.com/food/article/crispy-lentil-fritters				2								

Food Code	Food name in Bengali	Source	NIA (mg)	NIATRP (mg)	VITB6A (mg)	FOL (mcg)	ASCL (mg)	SFA	MUFA	PUFA	Pantothenic Acid	Vitamin B12	Sugars	Cholesterol
8	Sobji-Khichuri	http://www.myfitnesspal.com/food/calories/homemade-vegetable-khichdi-w-white-rice-259194137					0.12	2	9	1				
8	Sobji-Khichuri	https://recipes.sparkpeople.com/recipecalories.asp?recipe=93961					0.12	1.4	0.08	1				
9	Maggi Soup	https://www.maggime.com/maggi-range/maggi-soups/vegetable-soup/english/												
9	Maggi Soup	Proximat nutrient value (lab analysis)												

Appendix-7 **Measuring cup and equivalent**

Weighing Machine

Measurement cups and spoons

Liquid or Volume measures approximately			
1 teaspoons (tsp)	1/3 tablespoons	5 ml	100 gm
1 tablespoon (tbsp)	3 teaspoons	15 ml	500 gm
1 cup	16 tablespoons	240 ml	8000 gm

Cooking measurement equivalents

Appendix-8 Recipe Preparation in Photograph

Bean Soup

Soup

Sooji Kheer

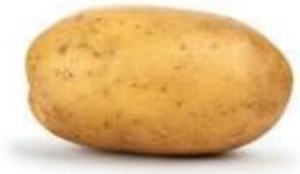
Luchi

Milk Semai












Sobji Khichuri

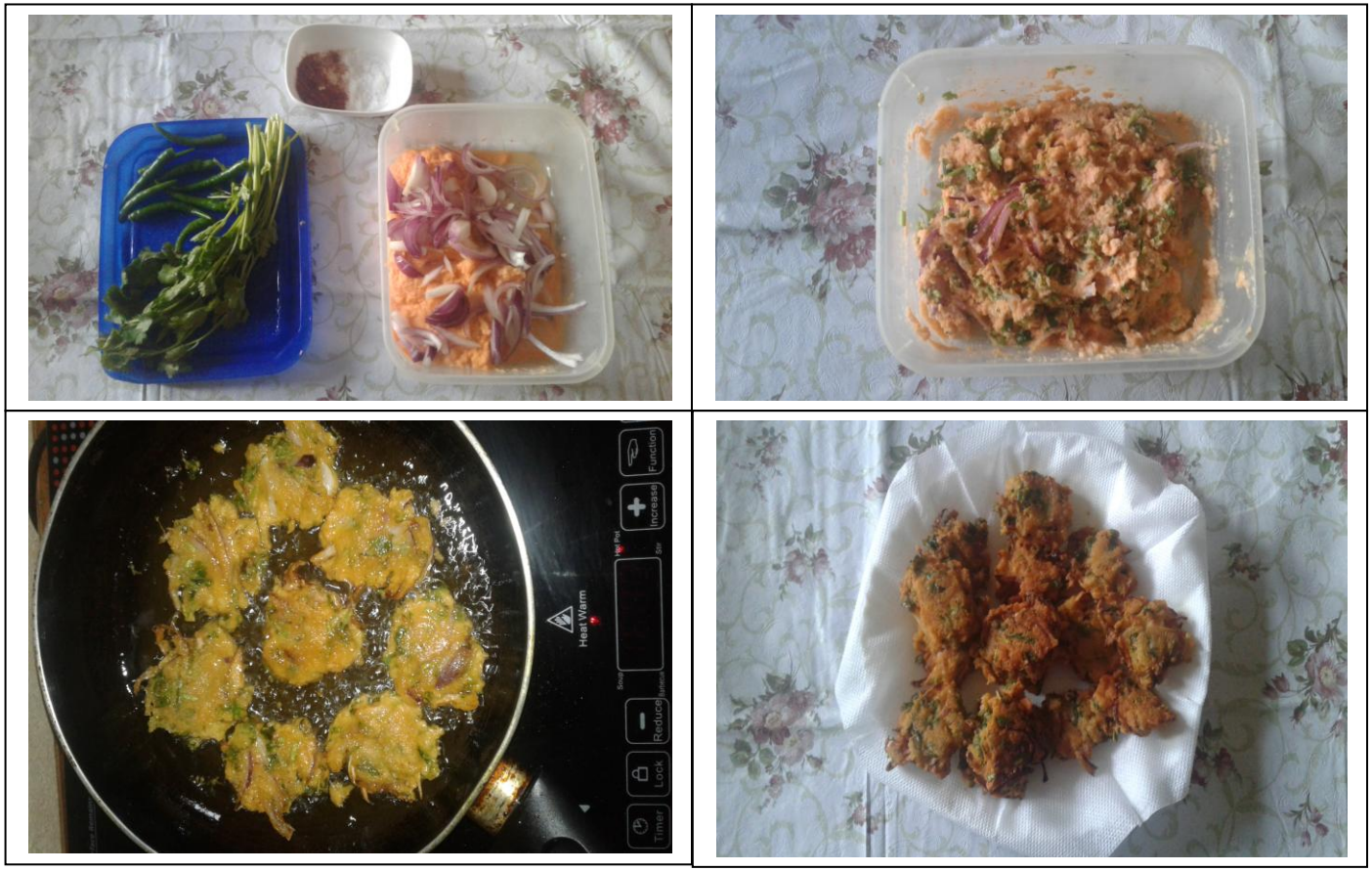





Payesh

Noddles



Masoor daler bora