Rural Dietary Intake Analysis Through Micro Level Food Balance Sheet Approach

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Introduction

Food is essential from the beginning to the end of life. For growth, development and promotion of life, sound planning of production, procurement and budgetting of food is of utmost importance.

A balance sheet may be defined as a statement drawn up at the end of each trading of financial period, setting for the various assets and liabilities of the concern at a particular period. Thus food balance sheet is to assess the food and nutrition situation in a simple way by comparing the gross availability of food expressed as energy and nutrient supply per capita with the corresponding requirements. This method can tell us how far a country or a community is in short supply when the food is distributed according to the physical needs. But in reality the rich take all that they need even more but the poor take only what they can afford. So there are limitations in the food balance sheet approach in assessing food and nutrition situation. Therefore the food balance sheet method must be supplemented by data of dietary surveys to provide information on the distribution and intake among individuals during different seasons and different ecological regions. In the present study an attempt is made to construct a food balance sheet on the basis of the household information on production and consumption of food by the members of the household.

Methodology

(i) Selection of Location:

Among the 64 districts, 13 (thirteen) districts were purposively selected. Later on from each of these selected districts one upazila was selected for the study. The villages were selected using following criteria:

(a) easily accessible and representative of typical rural village of Bangladesh.

(b) adjacent to upazila head quarters

(ii) Selection of Interviewers

Thirty interviewers were selected from these 13 (thirteen) upazilas (at least two from each upazila). After selection they were given intensive training on how to collect informaiton about production and consumption of different crops and other food items using a standard questionnaire. The senior faculty members of the Institute of Nutrition and Food Science, University of Dhaka and the experts or consultants served as trainers. The interviewers

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were mainly Government employees posted in the respective upazila headquarters, health complexes and high schools.

(iii) Selection of Households

From each selected village at least thirty houseolds were randomly selected following a systematic sampling procedure with a random start. A total of 871 household, from the fourteen selected villages could thus be included in the study. The head of the selected households or senior members of the family were interviewed using a standard and pre-tested questionnaire.

Calculation for Gross Availability of Food

The assessment of food consumption may be direct or indirect. The indirect method of the food balance sheet summarizes national data to give an overall picture of the patern of food consumption. Estimates of the total production of individual food items in a country are adjusted for imports, exports and wastage to obtain estimates of gross food supplies. The method is to calculate for each of the several food items and the gross availability is given by-

$A = P+S_1 + I-S_2 - E-M-W-S-F,$ .....(1) where "P" stands for the production of each of the several foods grown in the country;

"S_1" and "S_2" stand for the stocks in the beginning and end of the year;

"I" stands for imports in the course of the year;

"E" stands for exports in the course of the year;

"M" stands for the amount spent on manufacturing inedible foods;

"W" for waste:

"S" for seed;

"F" for food

For present study let us consider a total of a food items for which gross availability is to be calculated separately. The gross availability in a country for the ith food item, Ai, is obtained by-

$A_i = P_i + S_{1i} + I_i - S_{2i} - E_i - M_i - W_i - S_i - F_i$..... (2)

$i = 1,2$..... q

The above grosss availability for the ith food item can be calculated for a country. Howover, this can be computed on the basis of household information regarding production and consumption of the ith food item as well. Let us consider that Kth household k=1,2....., nj) of Jth district (j=1,2.....r) in a country has a gross availability of food item as shown below,

$A_{ijk} = P_{ijk}+S_1{}_{ijk}+I_{ijk}-S_2{}_{ijk}-E_{ijk}-M_{ijk}-W_{ijk}-S_{ijk}-F_{ijk}$.....(3)

$i = i,2$.....q;

$j = i,2$..... r;

$k = 1,2$ .....nj.

where $\sum_{j=1}^{n} nj = n$ = total number of household

The notation used in (3) are simple generalization of the notations used in (2) for the kth household of the jth district. The notations such as Iijk and Eijk represent the amount of the ith food item bought and sold by the kth household of the jth district

during the reference period respectively. From the expression (3), we obtain

$$Aij = \sum_{k=1}^{nj} Aijk = \ldots\ldots\ldots\ldots (4)$$

= The gross availability of the ith food item for the jth district.

and $Ai = \sum_{J=1}^{r} Aij$

$$Ai = \sum_{k=1}^{nj} \sum_{J=1}^{r} Aijk \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

= the gross availability of the ith food item in the country.

Hence we can use formula (2) to obtain formula (1) and thus the household information can be utilized to find the gross availability of food in a country indirectly for each of the the q food items under consideration. Per capita food availability of food can be obtained as follows:

Per capita availability of food

$$a = \sum_{i=1}^{q} Ai / \sum_{j=1}^{r} \sum_{k=1}^{nj} njk \ldots\ldots\ldots\ldots (6)$$

Where njk is the number of individuals in the Kth household of the jth district.

Gross availability as calculated with the above formula is then converted in terms of energy and nutrients using food consumption tables and summed overall foods to give energy and nutrient supply per capita.

Collection of Data

Data were collected from the sampled household by house to house survey. For the purpose of this study questionnaire used included the village description, family size of the person interviewed, annual household production and the annual household consumption of the different crops and other food items. The questionnaire was prepared in the light of the experience gained from class room and pilot exercise on food balance sheet preparation. Before collection of data the questionnaire was pre-tested and where needed it was modified and standardized.

Results

A total of 871 households were selected. The number of households interviewed ranged from 30 to 110 with an average of 63 (Table 1).

Table-2 shows that animal food constituted 47.53 gm which was only 6.17% of the total intake, 27% being received from production and the rest from purchase. Among the animal sources, it was found that fish intake was relatively high though it constituted only 2.63% of the the total intake. Again more than two-thirds of the fish intake was derived from purchase. The members purchased only 0.41 gm of milk out of 18.15 gm intake. The major contributor to dietary intake is the plant source, out of 723.12 gm 515.07 gm (66.83%) came from cereals. Of the cereal intake, 428.29 gm was from own production and 86.78 gm was from purchase. The pulse intake was 8.05 gm which was 1.04% of the total dietary intake. Contribution of fruit was only 18.62

gm of which 15.24 gm came from own production. Oil contributed 6.67 gm. which was only 0.87% of the total intake. Vegetables contributed 103.94 gm of which 96.51 gm was from purchase. Of the total intake of 770.65 gm it was found that 527.62 gm was from production showing a deficit of 243.03 gm.

Average contribution of calories was 2099.71±255.06 in all districts (Table-4). Plant products contributed 2049.90±254.32 calories of which 1864.44±236 calories came from cereals and 49.26±5.2 calories from animal products. Rice contributed 83.61% of the total calorie intake. Average protein intake was 46.45±4.23 gm. About 14.22% protein was contributed from animal products and 85.78% from plant products. The major fat intake from plant products which was 10.35±9.30 gm out of 12.71±9.30 gm. Edible oils contributed 52.08% of the total fat intake. Meat contributed only 1.02% of the total fat intake.

Out of total intake of 270.80 mg calcium, 172.81 mg came from plant products, animal products contributing only 97.99 mg (Table-5). Average intake of iron (Fe) was 43.34 mg of which plant product contributed 42.75 mg. This contribution came from meat, milk and cereals, which was 0.04 mg, 0.04 mg and 20.30 mg respectively.

The average vitamin B_2 intake was 1.73 mg of which animal products contributed 1.15 mg., rice and wheat contributed 0.43 mg and 0.04 mg of vitamin B_2 respectively. The average vitamin C intake was 36.20 mg of which contribution of 34.77 mg, 1.43 mg and 9.43 mg were from plants, animals and fruits respectively.

Table-6 shows the comparison of the current food intake study of 13 districts with the national nutrition survey of 1981-82 and 1975-76. The current intake of rice per person/day was 480.90 gm. The National Nutrition survey of 1975-76 and 1981-82 showed 493.00 gm and 451.00 gm of rice respectively. From current study the quantity of wheat intake was 34.15 gm/person/day, but in previous two national nutrition survey it was 29.00 gm/person/day, and 31.00 gm/person/day respectively.

Average cereal intake in this study was 515.07 gm which is higher than the intake in 1981-82 (482gm) but was lower than that in 1975-76 (522gm). The intake of roots and tubers was 59.58 gm in this study which was less than National Nutrition survey in 1981-82 (63gm).

This study showed the intake of 8.05 gm pulse/person/day. National Nutrition survey of 1975-76 and 1981-82 showed the intake of 23.80 gm/person/day and 8.00 gm/person/day respectively.

From the table the vegetable intake was 125.70 gm/person/day in 1975-76 and 120.00 gm/person/day in 1981-82, but the current study showed that it was only 103.94 gm/person/day.

The intake of oil has increased from 2.00 gm/person/day (1975-76 survey) and 3.00 gm/person/day (1981-82 survey) to 6.67 gm/person /day.

The current intake of sweets was 10.15 gm/person/day which was 8.70 gm/person/day and 7.30 gm/person/day in survey years 1981-82 and 1975-76 respectively.

The table further shows that the intake of plant products has increased compared with the intake in 1981-82. The current intake was 723.12 gm/person/day which was 753.70 gm/person/day in 1975-76 and 702.10 gm/person/day in 1981-82 respectively.

According to National Nutrition Survey 1975-76 and 1981-82, meat intake per person per day was 3.80 gm and 5.00 gm respectively. But the current study showed meat consumption of 4.33 gm/person/day. The intake of fish was 20.13 gm/person/day. The corresponding figure of fish intake in the National Nutrition Survey of 1975-76 and 1981-82 was 23.00 gm/person/day.

The intake of milk has increased from 15.00 gm/person/day (1981-82 survey) to 18.15 gm/person/day/ Again the intake of egg has increased from 1.2 gm/person/day of 1981-82 to 4.75 gm in the present study.

As a whole Table-6 showed the grand total intake of different food groups in gm/person/day. It is seen that the total intake do not vary substantially. The current intake was 770.65 gm/person/day which was 789.50 gm/person/day in 1975-76 and 765 gm/person/day in 1981-82 respectively.

The present study shows that the total calorie intake was 2099.71 calorie/person/day compared to 1943 calorie in 1981-82 and 2094 calorie in 1975-76 surveys.

Discussion

The formulation of food balance sheet is a cumbersome process and it has relationship with adequate resourec management. Though we have not been able to make national food balance sheet yet, this research at the micro level is an attempt to focus on the present food situation interms of availability, consumption and utilisation. In the absence of recent nutrition survey, these findings will enlighten us on the current situation. As such the result obtained from this study were compared with nutrition survey of 1975-76 and 1981-82 these were not strictly comparable.

In the present study 13 districts were purposively selected and then from each of these selected district one upazila was seleted for study. Among these 13 upazilas 14 villages were selected, one from each upazila on the basis of some pre-fixed selection criteria, where as in national nutrition survey, locations were selected randomly in two systematic sampling method. Finally a pilot survey was conducted and the

Table 1 : Distribution of households interviewed by location

District	Upazila	Village	No. of household Interviewed
Gazipur	Gazipur	Titarkul	30
Mymensingh	Phulbaria	Phulbaria	50
Comilla	Comilla	Belasar	70
Noakhali	Chatkhil	Singbahura	110
Chittagong	Rangunia	Chathek	75
Khagrachari	Ramgar	Masterpara	60
Dhaka	Tejgaon	Uttar Khan & Satarkul	66
Patuakhali	Narayagonj	Pashchim Sabud Ali	60
Bogra	Gabtali	Boragardha	65
Dinajpur	Phulbari	Rajarampur	64
Jessore	Jhikargacha	Radmapukur	68
Rangpur	Mithapukur	Chitali	102
Madaripur	Madaripur	Alamdanga	51
Total			871

Table 2 : Average production and intake (gm/person/day) by food groups of all district (edible part)

Food groups	From production (gm)	From purchase (gm)	Total intake (gm)	Percentage of total food intake
Rice	405.73	75.21	480.94	62.40
Wheat	22.56	11.52	34.13	4.43
Cereals	428.29	86.78	515.07	66.83
Roots & Tubers	34.64	24.94	59.58	7.73
Pulses	3.64	4.41	8.05	1.04
Vegetables	7.43	96.51	103.94	13.49
Oils	2.96	3.71	6.67	0.87
Sweets	8.42	2.79	11.21	1.45
Fruit	15.24	3.36	18.60	2.42
Plant Production	500.62	222.50	723.12	93.83
Meat	2.68	1.65	4.33	0.57
Fish	3.52	16.78	20.30	2.63
Milk	17.74	0.41	18.15	2.35
Egg	3.06	1.69	4.75	0.62
Animal Production	27.00	20.53	47.53	6.17
Grand Total	527.62	243.03	770.65	100.00

Table 3: Average total food intake (gm/person/day) from production and purchase in different district.

Name of district	From production	From Purchase	Total intake
Mymensingh	354.02	366.48	720.50
Gazipur	547.14	145.86	693.00
Jessore	591.55	171.93	763.48
Noakhali	439.51	272.69	712.20
Comilla	493.92	246.88	740.80
Madaripur	429.37	319.43	748.80
Chittagong	417.67	321.13	738.80
Dhaka	267.48	474.52	742.00
Khagrachari	476.47	237.13	713.60
Patukhali	710.00	191.27	901.27
Bogra	786.09	132.58	918.67
Dinajpur	713.57	121.54	835.11
Rangpur	632.32	157.95	790.27
Total	6859.11	3159.39	10018.50
Mean	527.62	243.03	770.65
SD	±147	±101.17	±69.05

Table 4: Average nutrient intake (person/day) by food groups in all districts (edible part) along-with standard deviation.

Food Groups	Caloric Intake		Protein Intake		Fat Intake	
	Kcal	%	(gm)	%	(gm)	%
Rice	1755.54±229	83.61	30.70±4.01	66.26	1.92±0.25	15.11
Wheat	108.90± 51	5.19	4.03±1.46	8.68	0.51±0.19	4.01
Cereals	1864.44±236	88.80	34.81±4.18	74.94	2.43±0.30	19.12
Roots & Tubers	64.72±6.19	3.08	0.83±0.08	1.77	0.27±0.03	2.12
Pulses	1.94±0.48	0.09	1.85±0.47	3.98	0.15±0.04	1.18
Vegetables	36.09±4.27	1.72	2.10±0.21	4.51	0.68±0.09	5.35
Oils	60±83.27	2.87	-	-	6.62±9.27	52.08
Sweets	12.66±6.02	0.60	0.05±0.04	0.12	0.13±0.12	1.03
Fruit	10.03±2.63	0.47	0.21±0.05	0.46	0.07±0.02	0.55
Plant Production	2049.90 ± 541.32	97.63	39.85±4.25	85.78	10.35±9.30	81.43
Meat	5.18±1.50	0.25	0.99±0.29	2.13	0.13±0.04	1.02
Fish	23.54±2.93	1.12	4.41±0.55	9.49	0.84±0.10	6.62
Milk	12.35±3.07	0.59	0.59±0.15	1.27	0.75±0.19	5.90
Egg	8.38±4.21	0.41	0.64±0.32	1.38	0.64±0.32	5.03
Animal Product	49.26±5.21	2.37	6.61±0.66	14.22	2.36±0.34	18.57
	2099.71±255.06	100	46.45±4.23	100	12.71±9.30	100

Table 5 : Average nutrient intake (person/day) by food groups in all district (edible part)

Food groups	Calcium (gm)	% of calcium intake	Iron (mg)	% of Iron	Vit.-B2 (mg)	% of Vit/B_2	Vit.-C	% of Vit.-C
Rice	43.31	15.99	19.24	44.39	0.43	24.43	-	-
Wheat	14.07	5.20	1.68	3.88	0.04	2.27	-	-
Cereals	57.38	21.19	20.92	48.27	0.47	26.70	-	-
Rooots/Tubers	13.54	5.00	0.66	1.52	0.02	1.14	5.24	14.48
Pulses	6.78	2.50	0.57	1.32	-	1.70	0.08	0.22
Vegetable	59.44	21.95	20.30	46.84	0.08	4.55	20.02	55.30
Oils	-	-	-	-	-	-	-	-
Sweets	35.05	12.94	-	-	-	-	-	-
Fruits	0.62	0.23	0.30	0.69	0.01	0.57	9.43	26.05
Plant Prod	172.81	63.81	42.75	98.64	0.58	34.66	34.77	96.05
Meat	0.56	0.21	0.04	0.09	-	-	-	-
Fish	64.19	23.70	0.40	0.92	0.02	1.14	1.15	3.17
Egg	2.85	0.05	0.11	0.35	0.01	0.57	-	-
Milk	30.39	11.22	0.04	0.09	1.12	63.64	0.28	0.78
Animal prod	97.99	36.19	0.59	1.36	1.15	05.34	1.43	3.95
Grand total	270.80	100	43.34	100	1.73	100	36.20	100

Table 6 : Food Intake (gm/person/day) in National Nutrition Suvery Years and Current Study

Food Grups	Current Study	National Nutrition Survey 1981-82	National Nutrition Survey 1975-76
Rice	480.94	451.00	493.00
Wheat	34.13	31.00	29.00
Cereals	515.07	482.00	522.00
Roots & Tubers	59.58	63.00	52.30
Pulses	8.05	8.00	23.80
Vegetables	103.94	120.00	125.70
Oils	6.67	3.00	2.00
Sweets	11.21	8.70	7.30
Fruit	18.60	17.40	20.60
plant Prod	723.12	702.10	753.70
Meat	4.33	5.00	3.80
Fish	20.30	23.00	23.00
Milk	18.15	15.00	16.80
Egg	4.75	1.20	1.20
Animal Products	47.53	44.20	44.80
Grand Total	770.65	746.30 + others = 765	798.50

Vegetable during this study period was not available as this period was post harvesting period.

Table 7: Nutrient Intake (person/day) in National Nutrition survey Years and Current Study

Nutrients	Current Study	National Nutrition Survey 1981-82	National Nutrition Survey 1975-76
Calorie	2099.71	1943.00	2094.00
Protein	46.45	48.40	58.50
Fat	12.71	9.80	12.20

questionnaire was than modified to ensure the capability of the interviewer in the collection of the data. In this study total number of households interviewed was 871, where as in national nutrition survey (1981-82) the total mumber of households interviewed was 597. However, this study used recall method whereas national nutrition surveys did dietary survey using actual weighing method.

The amounts of different food items in this study when compared with the national mutrition survey of 1981-82 showed decreased consumption of roots and tubers, vegetables, meat and fish. The decreased consumption of roots and tubers by 5% may be attributed due to increased cereal consumption. This study was conducted during harvesting seasons (jute and paddy) when there were dearth of vegetables availability. This is being reflected by this decreased consumption of vegetables.

However, the increase consumption of plant products showed less affordability for animal products. The manifold increased consumption of eggs may be due to current awareness of poultry production and protection as well as more acceptance of nutrition education[3]. All other food items marked increased intake whcih may be due to changes in attitude of the public towards balanced diet.

The current study revealed that the calorie and fat intake were higher than the intakes as per last national nutrition survey figures (Table-7). However, the consumption of protein was found to be decreasing since 1975-76. Nationally, due to less production of oilseeds, the overall fat intake is lower.

This study illustrates the available food situation at a particular time in rural Bangladesh. The outcome of which is recommended to be used as a tool while formulating micro and macro level policy planning and food balance sheet.

Summary

Food balance sheet is used to assess the food and nutrition situation in a given time by comparing the gross availability of food expressed as energy and nutrient supply per capita, Real situation being that the rich take all they need and the poor take only what they can afford. In order to know the real situation the data on distribution and intake at micro level was attempted.

This study was conducted in 13 (thirteen) districts when compared with national nutrition survey of 1981-82 showed that consumption of roots and tubers, vegetables, meat and fish decreased while intake of plant product and eggs increased. Calorie and fat intake were higher. Intake of protein was found to be decreasing since 1975-76. Less intake of vegetable is explained by the fact that during study period production and supply of vegetable was less. The study indicates a change in the attitude of the public towards balanced diet and illustrates the food situation in rural Bangladesh at a particular season. It can be used as a tool while formulating micro and macro level policy planning and food balance sheet.

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