REFERENCE ASIAN MAN PROJECT (PHASE 2)

STUDIES IN THE PHILIPPINES ON INGESTION AND ORGAN CONTENT OF TRACE ELEMENTS OF IMPORTANCE TO RADIOLOGICAL PROTECTION

by

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INTRODUCTION

The first Coordinated Research Program (CRP) on Reference Asian Man was conducted for a period of six years. This study dealt with the collection of data in four areas namely, anthropometric measurements, organ mass measurements, nutritional and dietary intake, pulmonary and water balance studies. Results of this study participated by eight Asian member states including the Philippines are contained in the IAEA TECDOC-1005 [(1)].

Based on research needs with reference to radiation protection, dietary intake and tissue analysis appears to be important aspects of the RAM. Hence, the first CRM for Phase 2 held in Manila July 1-4, 1996 strengthened the need to continue the project. Protocols on its implementation were discussed during this meeting. The Philippines presented a report that described the sampling and analytical methods that will be applied[(2)].

This report aim to present the initial samples collected as well as the data generated from these samples. Elements of interest to radiation protection include Sr, Th, U, I, Cs and trace elements present in food, water and in selected tissues such as liver, lung, kidney, thyroid and bone.

FOOD SAMPLING

Information from the expert on nutritional profile of the Filipino, the Food and Nutrition Institute (FNRI) showed further decline in the quantity of food in the basket of the consumer[(3-6)]. Table 1 shows the daily food consumption survey conducted by FNRI every 5 years. This year, FNRI will be conducting its fifth nationwide survey. It is expected that due to the Asian economic crisis, households will experience further reduction in the quantity of food in their baskets due to the deteriorating value of the Philippine peso.

Two types of sampling methods were adopted. Duplicate one-day diet samples were prepared from basket samples. Edible portions were cooked and prepared based on FNRI's table on most commonly eaten meals by region[(7)]. This method was used in

the preparation of food samples taken from regions 1-5 and NCR. Test meals include breakfast, lunch, dinner and one snack (AM or PM).

Another method of sampling which was used in regions 10-12 is the collection of one day composite diet samples taken from school cafeteria and "carinderias" where the urban community often get their food.

Table 2 presents the regional food sampling conducted in 9 regions with the corresponding sample size and weight.

ANALYSIS OF ELEMENTS IN FOOD SAMPLES

1. Pre-treatment

One-day test meal was pooled together and placed in labeled polyethylene bags, weighed and stored in refrigerator before sample preparation was done.

In the laboratory, the sample was thawed at room temperature and homogenized using stainless steel blade into a creamy consistency. The sample was transferred to a weighed beaker and dried to a constant 70°C in an air convection oven. After drying, the sample was pulverized using a mortar and mixed thoroughly using a spatula. An aliquot of about 100-200 gram sample was transferred to a crucible before ashing in the muffle furnace. The temperature was raised slowly to 450°C. Samples were packed and sent to NIRS for analysis. At NIRS, samples were further digested using high purity nitric acid using PTF pressure vessel and pressure-controlled microwave oven. Perchloric acid and hydrogen fluoride were used to obtain solutions free of carbonaceous and siliceous materials.

2. Analysis

Sample solutions were appropriately diluted and subjected to ICP-MS determination of Sr, Cs, Th and U. Bismuth-210 was used as an internal standard for Th and U. Accuracy and precision of the analysis were known using NIST Standard Reference Material, SRM 1575 pine needles and by comparing results with certificate values.

RESULTS

1. Sampling

The average weight of one-day test meal taken from regions 1-5 representing rural areas of the country is 1450.2 grams while test meals coming from NCR weighs 1860 grams.

Regions 10-12 except Camiguin are classified as other urban areas. The average weight of one-day meal from these regions is 1422.3 grams for male and

110

1077.6 grams for female. Based on the 1993 FNRI nationwide survey on food consumption, NCR posted the highest quantity followed by other urban areas. The rural areas recorded the lowest quantity [6].

Drinking water was also collected which approximately totaled to 1.2 liter consumed per day excluding beverages such as coffee, milk, chocolate and other local herbal drinks.

2 Analysis

Initial results of two diet samples for the elements Sr, Cs, Th and U are given in Table 3. Mean value for Sr is from 0.18-0.22 mg/g-dry, Cs is from 0.797-1.45 μg/g-dry weight, Th is 0.0293-0.0831 μg/g-dry weight and U is from 0.0370-0.0927 μg/g-dry weight.

Studies conducted in Japan from 1967-1986 showed the daily intake of elements by Japanese adult (Table 4) as compared to the value obtained in this study[8]. Results show that data obtained from the Philippines are lower than the Japanese data.

RECOMMENDATION

The implementation of RAM Phase 2 Project is slow due to financial stress being experienced by the participating country. The diminishing budget from twenty thousand (PHP 20,000 = $500.) last year to this year's allocation of thirteen thousand (PHP 13,000 = $325) is definitely insufficient to be able to deliver the sample size presented in Table 5. With reference to food sampling, it is recommended that this activity should be conducted in the respective regions to be able to arrive at the so-called real samples.

Another component is the human tissue sampling which did not materialized due to lack of incentive to be given to the medical practioners.

In view of the above financial situation, a realignment of the research contract is important to be able to channel additional funds for the project.

Likewise, the request for NIRS to continue analyzing the samples is necessary to be able to renew the contract.

TABLE 1. MEAN ONE DAY PER CAPITA FOOD CONSUMPTION BASED ON FIVE YEAR SURVEY

FOOD GROUP	FNRI			
	1978	1982	1987	1993
	CONSUMPTION (Raw as Purchases), in grams[1]			
Rice and Products	308	304	303	282
Corn and Products	38	34	24	36
Cereal and Products	21	18	18	32
SUBTOTAL	**367**	**356**	**345**	**340**
Starchy Roots and Tubers	37	42	22	17
Sugars and Syrups	19	22	24	19
Fats and Oils	13	14	14	12
Fish and Products	102	113	111	99
Meat and Products	24	32	37	34
Poultry	7	10	9	14
SUBTOTAL	**132**	**155**	**157**	**147**
Eggs	8	9	10	12
Whole Milk	31	30	36	35
Milk Products	11	14	7	9
SUBTOTAL	**42**	**44**	**43**	**44**
Beans, Nuts and Seeds	8	10	10	10
Green Leafy and Yellow	34	37	29	30
Other Vegetables	111	93	82	76
SUBTOTAL	**145**	**130**	**111**	**106**
Vitamin C-Rich Fruits	30	18	24	21
Other Fruits	74	84	83	56
SUBTOTAL	**104**	**102**	**107**	**77**
Beverages	8	17	12	9
Condiments and Others	13	15	14	11
SUBTOTAL	**21**	**32**	**26**	**20**

NOTES: (1) As available in the kitchen including inedible and edible wastage.

112

TABLE 2. 1998 ONE-DAY MEAL FOOD SAMPLING

REGION	PROVINCE	No. OF SAMPLES	SEX	SOURCE	WEIGHT (gm)	DATE OF SAMPLING
1	Ilocos*	2	F	Basket Sampling	1800	1997
2	Cagayan*	2	F	-do-	1558	1997
3	Central Luzon*	2	F	-do-	1283	1997
4	Southern Luzon*	2	F	-do-	1232	1997
5	Bicol*	2	F	-do-	1378	1997
	NCR*	2	F	-do-	1860	1997
10	Cagayan de Oro City	4	2M, 2F	Cooked Meals	1606, 1205	1998
	Camiguin	4	2M, 2F		1637, 900	
11	Butuan City	4	2M 2F	-do-	1355 1020	1998
12	Iligan City	4	2M 2F	-do-	1306 1008	1998

Note: * Samples contain beverages but without drinking water.

TABLE 3. RESULTS OF ANALYSIS OF TWO PHILIPPINE DIET SAMPLES

(K. Shirasishi, H. Arae and H. Kawamura, NIRS, April 7,1998)

		Sr			Cs			Th			U		
		mg/g-dry	Mean	SD	µg/g-dry	Mean	SD	µg/g-dry	Mean	SD	µg/g-dry	Mean	SD
D-005-1 Ilocos #1	1	0.21			1.04			0.0787			0.0958		
	2	0.23			1.09			0.0387			0.0975		
	3	0.21			1.09			0.1020			0.0915		
	AV		0.22	0.01		1.08	0.03		0.0831	0.0316		0.0927	
D-005-2 Ilocos #2	1	0.19			0.776			0.0329			0.0412		
	2	0.19			0.823			0.0281			0.0373		
	3	0.18			0.793			0.0268			0.0393		
	AV		0.19	0.01		0.797	0.024		0.0293	0.0032		0.0370	0.0020
D-006-1 Bicol #1	1	0.18			1.18			0.0570			0.0651		
	2	0.18			1.25			0.0436			0.0573		
	AV		0.18	0.01		1.21	0.05		0.0503	0.0095		0.0690	0.0058
D-006-2 Bicol #2	1	0.19			1.51			0.0445			0.0611		
	2	0.20			1.40			0.0428			0.0611		
	AV		0.19	0.01		1.45	0.07		0.0437	0.0013		0.0584	0.0007
Pine Needles SRM-1575	1	0.0046			0.115			0.0349			0.0198		
	2	0.0045			0.121			0.0323			0.0185		
	3	0.0047			0.117			0.0360			0.0211		
	AV		0.0046	0.0001		0.118	0.003		0.0344	0.0019		0.0198	0.0013
Cert. Value		0.0048						0.037			0.0200		
Ratio **		95.83						92.92			99.00		
Orchard Leaves SRM-1571	1	0.040			0.041			0.0346			0.0241		
	2	0.039											
	AV		0.039	0.001			0.0003			0.0020			0.0009*
Cert. Value		0.037			0.040			0.0640			0.0290		
Ratio **		105.41			101.25			100.91			83.11		

NOTES: * SD of three measurements. ** Ratio (%) of present result certified value.

TABLE 4. COMPARISON OF DAILY DIET INTAKE OF SR, CS, TH AND U - JAPAN AND PHILIPPINES

COUNTRY	Sr, mg	U, µg	Th, µg	Cs, µg
Japan	2.3	0.64	0.36	—
Philippines (Initial data)	0.18 - 0.22	0.0370 - 0.0927	0.0293 - 0.0831	0.797 - 1.450

TABLE 5. RAM Phase 2: Projected Food Samples for 1998-1999*

AREA	TOTAL	MALE	FEMALE
PHILIPPINES	**110**	**55**	**55**
National Capital Region	10	5	5
I. Ilocos Region	6	3	3
CAR	6	3	3
II. Cagayan Valley	6	3	3
III. Central Luzon	8	4	4
IV. Southern Tagalog	14	7	7
V. Bicol Region	8	4	4
VI. Western Visayas	8	4	4
VII. Central Visayas	6	3	3
VIII. Eastern Visayas	8	4	4
IX. Western Mindanao	4	2	2
X. Northern Mindanao	8	4	4
XI. Southern Mindanao	8	4	4
XII. Central Mindanao	4	2	2
ARMM	6	3	3

* Computed from FNRI's number of sample households by region: Philippines, 1993