"REFERENCE JAPANESE MAN" AS A MODEL OF MAN FOR DOSE EQUIVALENT ESTIMATION

G. Tanaka, H. Kawamura and K. Shiraishi
Division of Radioecology, National Institute of Radiological Sciences
3609 Isozaki, Nakaminato, Ibaraki 311-12, Japan

Introduction

A program on physical and physiological characteristics of the Japanese is in progress in conjunction with importance of such data in establishing "Reference Japanese Man", a mathematical model for the dose equivalent estimation for radionuclide intakes. This is more important with respect to the general public including children. Moreover, data on variations to apply ICRP Reference Man to populations with different racial characteristics are needed(1-3). It is also expected that the Reference Man concept will need revision and extension(4).

Mass of organs, daily consumption of various nutrients in the diet, daily intake and skeletal content of some alkaline earth elements, and metabolic parameters for radioiodine in the thyroid gland was reported for the Japanese were reported previously(1,2).

In the present paper, age dependency of the mass of organs, mass of the mineralized bone and some results of determination of elements in tissues as well as further examination of radioiodine metabolism in the Japanese are to be reported.

1. Mass of Organs of the Normal Japanese of Various Ages

Age dependency is one of the factors of great interest in dose and risk evaluation and growth in mass of organs and tissues is essential data in dosimetry. Substantial data are available for the Japanese children and adolescents(1). Age of reference is often given as 1, 5, 10 and 15 years. Presently mass of organs is shown for the age groups, 1-2, 5-6, 9-10, 15-16 yr and the adult as in Fig. 1.

2. Mass of Mineralized Bone and Tissues in Bone

Estimated weight of bone as well as the distribution of mineralized bone in skeleton is being studied along with mass of cells near bone surfaces and active red bone marrow in the Japanese because of significance of these data in dosimetry(5). In the previous papers(1, 2), mass of the total skeleton of a "Reference Japanese" adult male was estimated as 8.4 kg using a weight ratio between the skeleton and total body, 0.14 which is assumed by ICRP(4). Since then, by a thorough investigation of the published data on the weight of bones and by measurements of a considerable number of complete sets of bone specimens(6), estimates of the weight of bones were obtained for the Japanese adult male and female, which are believed to be equivalent to masses of the mineralized bone(4). The data are shown in Table 1. According to the result, mass of the mineralized bone is 4.2 and 3.2 kg for the "Reference Japanese" adult male and female weighing 60 and 51 kg, respectively(5). Mass of cells near bone surfaces and active red bone marrow was estimated approximately as 100 and 1000 g, respectively.

3. Concentration and Distribution of Elements in Tissues

Up to now, results of the determination of elements using trace analysis techniques were obtained for eleven elements in twelve types of tissue, including the brain, kidney, liver, spleen, pancreas, small and large intestine, skin and diaphragm. More number of analyses is required, but, it may be of interest to note some difference in the concentration of some elements between the tentative result and some of the ICRP assumptions(4).

Uptake of Radioiodine by and Biological Half Time in the Thyroid Gland in the Japanese

In Japan, high levels of natural stable iodine intake, about 1 mg per person per day is known to be common because several kinds of marine algae including iodine-rich kelp or tangle, raw and often dried, are almost essential foodstuffs in the Japanese diet(1).

Results of *in vivo* measurement for an experimental administration of radioiodine in the volantary, healthy and normal Japanese adult males to clarify influences of stable iodine intake on the metabolism of orally ingested radioiodine, I-131, were reported(1,2). The data were further examined recently(7). Peak uptake rate and biological half-time in the thyroid was 10.3 % and 28.9 d, respectively in a subject who continued to eat "normal" Japanese meals throughout the course of the study, and 28.9 % and 38.5 d for another subject who was prohibited from eating any algae and their products for two weeks until the administration to simulate a low level of stable iodine intake as has been assumed in European and North American nations(*i. e.* 0.2 mg). The data, along with other literature data for the Japanese, may confirm the present assumption that, in the normal Japanese adult whose intake level of natural stable iodine is 1 mg per day, the fraction of radioiodine deposited and the biological half-time in the thyroid gland is 0.15 and 35 d, respectively. These values are considerably lower than those assumed by the ICRP(8) and will have significance in the estimation of dose equivalent commitment for radioiodine, particularly of long half-lives, such as I-129 (8). This was shown theoretically using a five compartment model in which release of excess inorganic iodine from the thyroid is assumed by Kai(8).

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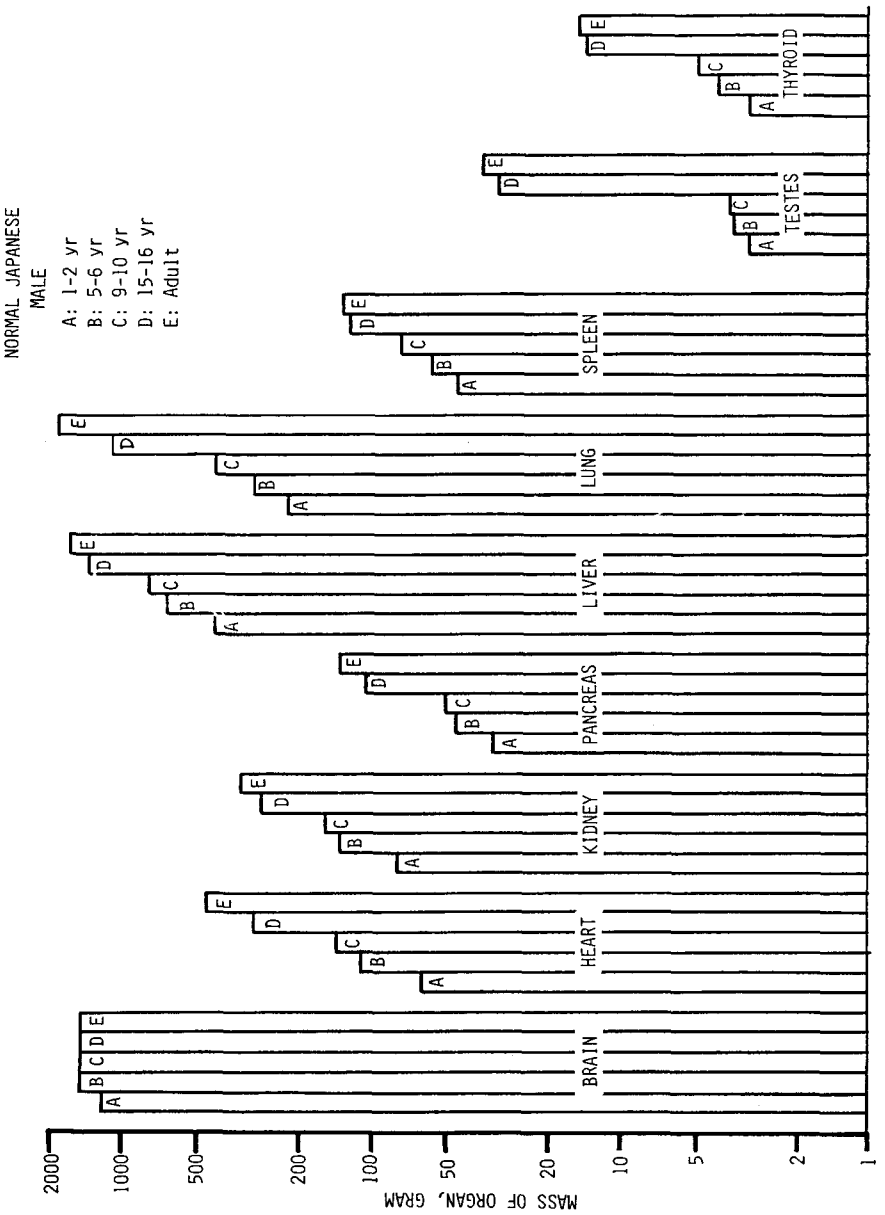

Fig. 1. Mass of organs by four different age groups

Table 1. Mass of the mineralized bone of the Japanese

Bone	Male	Female	Female/Male ratio
Skull(incl. mandible and teeth)	694	632	0.91
Scapula	129	97	0.75
Clavicle	50	38	0.75
Rib	307	230	0.75
Sternum	21	16	0.75
Vertebral column	384	288	0.75
Sacrum	83	62	0.75
Innominates	354	280	0.79
Humerus(2)	284	190	0.67
Radius(2)	90	60	0.67
Ulna(2)	112	76	0.67
Hands(2)	107	72	0.67
Femur(2)	781	571	0.73
Patella(2)	28	21	0.73
Tibia(2)	443	324	0.73
Fibula(2)	104	76	0.73
Feet(2)	229	167	0.73
Total	4200	3200	0.76