ESTABLISHMENT OF REFERENCE MAN IN THE REPUBLIC OF KOREA

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Abstract

The project on the Reference Korean was initiated in 1980. Physical data have been compiled for 21,406 Korean people, corresponding to 0.05% of total Korean population. All the data were divided into small groups according to the age and sex.

Internal organ mass data are cited from a report previously prepared the Chungham National University. The mass of Korean organs is similar to that of Japanese, but the weights of liver and pancreas were different with those of Japanese. This might be caused by the difference of the criterion of weighing methods but not by the real difference.

INTRODUCTION

There are two modes of exposure to radiation. One is the external exposure to natural radiation such as ^{40}K, uranium and thorium series radionuclides, and cosmic rays, as well as environmental radiation released directly from nuclear facilities. The other is the internal exposure to radiation released from natural or man-made radioactive substances inhaled or ingested through food chains.

Since radiation is known as a strong mutagen and a factor to induce life shortening in animals, there has been a strong effort to establish the acceptable maximum allowable level of exposure dose of radiation. Such maximum permissible exposure dose is applicable to man directly in case of external exposure, but quantitative data about the behavior of radioisotopes in the environment, bioaccumulation factor of radioisotopes and metabolism of radioisotopes are needed for the evaluation of radiological impacts on human population when it is internal exposure. With this viewpoint, Committee II of ICRP has compiled human characteristics as "Standard Man" in 1959 [1]. Later the Committee recompiled the data as Reference Man [2] in 1975 upon addition of supplementary data. The Japanese investigators have collected their specific anatomical and chemical data as "Reference Japanese" [3] since 1970 because their habitat and customs are different from those of the Caucasian.

When the levels of radiation exposure doses are sufficiently low, the values of Reference Man or Reference Japanese can no longer be applicable to the Korean population because of differences existing between the races and environments. Local specific data, therefore, are needed to obtain the precise estimation of radiation exposure doses for a given Korean. The project on the Reference Korean was planned and has been in progress since 1980. Some of the results are reported [4,5]. The present report is concerned with the human physiques of the Reference Korean.

METHODS

In order to determine the physical standards of Reference Korean, we have collected the data from the Industrial Advancement Administration [6] and recompiled them. Physical data of 21,406 Korean that corresponds to 0.05% of total Korean population were compiled. All the data were divided into small groups according to the age and sex. Surface area was not measured directly but calculated using the equation of Du Bois and Du Bois [7]. Data on the mass of Korean internal organs were collected and analyzed by us already (1,344 in male

TABLE I. NUMBER OF INDIVIDUALS ANALYZED

Age	Region								Total		
	Seoul	Kyung-gi	Kang-won	Chung-cheong	Pusan	Kyung-sang	Chon-ra	Che-chu			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
0 - 5	595	538	478	331	116	107	186	141	1,372	1,117	2,489
6	59	57	117	108	32	57	19	15	227	237	464
7	57	49	144	104	66	87	38	39	305	279	584
8	65	76	135	135	85	78	22	23	307	312	619
9	69	57	135	116	80	72	24	30	308	275	583
10	51	53	145	100	58	40	48	41	302	234	536
11	33	24	140	134	33	48	39	35	245	241	486
12	65	73	346	231	17	10	18	96	445	410	855
13	109	174	322	314	1	3	4	115	436	606	1,042
14	104	160	339	346	1	1	9	126	453	633	1,086
15	209	163	280	298	52	140	99	161	640	762	1,402
16	278	178	212	365	105	188	146	207	741	938	1,679
17	167	79	181	267	117	193	123	170	588	709	1,297
18	307	70	293	88	188	240	237	94	1,025	492	1,517
19	427	67	389	26	259	69	341	84	1,416	246	1,662
20	228	75	163	17	189	15	134	77	714	184	898
21 - 25	765	201	219	51	353	27	138	159	1,475	438	1,913
26 - 30	713	175	69	21	184	10	9	12	975	218	1,193
31 - 35	75	230	58	12	12	17	3	7	148	266	414
36 - 40	38	136	122	23	1	13	1	2	162	174	336
41 - 50	65	204	174	16	6	9	3	1	248	230	478
51 -	3	29	24	57	0	2	0	0	27	88	115
Sum	4,481	2,868	4,485	3,160	1,955	1,426	1,638	1,635	12,559	9,089	21,648

TABLE II. STATURES AS A FUNCTION OF AGE AND SEX

Age (Months)	Height - cm		Weight - kg		Sitting heights - cm		Acromion height - cm		Pubis heights - cm	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
36 - 41	96.7 ± 6.5	95.8 ± 4.6	15.4 ± 2.4	14.4 ± 1.3	56.2 ± 2.6	55.7 ± 2.3	74.3 ± 4.7	73.9 ± 5.1	39.2 ± 4.2	40.7 ± 3.0
42 - 47	100.2 ± 3.0	99.0 ± 2.4	15.6 ± 1.3	15.7 ± 1.5	57.9 ± 1.7	57.2 ± 2.0	77.1 ± 2.8	76.7 ± 2.3	41.6 ± 2.1	43.2 ± 1.9
48 - 53	103.4 ± 3.9	103.0 ± 3.9	16.9 ± 1.8	16.5 ± 1.9	59.2 ± 2.4	58.6 ± 2.4	80.0 ± 3.5	79.4 ± 3.9	43.3 ± 3.1	45.1 ± 3.5
54 - 59	106.8 ± 4.6	105.8 ± 4.6	18.0 ± 2.4	17.1 ± 2.1	60.7 ± 2.7	59.6 ± 2.6	82.7 ± 3.9	82.3 ± 4.3	45.9 ± 3.3	47.1 ± 3.4
60 - 65	109.3 ± 4.4	108.9 ± 4.1	18.5 ± 2.3	18.2 ± 2.3	61.6 ± 2.7	60.9 ± 2.5	85.0 ± 4.0	84.9 ± 3.8	47.6 ± 3.1	48.9 ± 3.0
66 - 71	111.8 ± 4.4	111.1 ± 4.1	19.4 ± 2.4	18.9 ± 2.3	62.8 ± 2.4	62.1 ± 2.3	87.1 ± 3.8	86.9 ± 3.5	49.9 ± 3.4	50.7 ± 3.1
6	117.0 ± 4.7	116.4 ± 4.4	20.8 ± 2.6	20.3 ± 2.6	64.8 ± 2.6	64.5 ± 2.5	91.7 ± 4.2	91.3 ± 4.0	52.2 ± 3.3	53.4 ± 2.9
7	121.5 ± 5.4	119.8 ± 5.0	22.8 ± 2.9	21.8 ± 3.0	67.0 ± 2.9	65.7 ± 2.6	95.6 ± 4.8	94.2 ± 4.6	54.9 ± 3.6	55.5 ± 3.6
8	126.5 ± 5.5	125.3 ± 5.3	25.5 ± 3.6	23.9 ± 3.5	68.8 ± 2.9	67.9 ± 2.8	100.2 ± 5.0	99.2 ± 4.7	59.0 ± 4.1	58.9 ± 3.6
9	131.3 ± 5.8	131.2 ± 5.6	27.7 ± 4.0	27.2 ± 4.3	70.8 ± 3.0	70.4 ± 3.1	104.2 ± 5.1	104.3 ± 5.0	61.6 ± 4.5	62.7 ± 3.7
10	135.8 ± 5.7	136.7 ± 6.2	30.7 ± 4.5	30.6 ± 5.1	72.6 ± 2.7	72.7 ± 3.4	108.4 ± 5.3	109.5 ± 5.4	64.9 ± 4.1	65.8 ± 3.8
11	140.4 ± 6.6	142.7 ± 6.8	33.4 ± 5.2	34.2 ± 6.1	74.7 ± 3.2	75.4 ± 3.7	112.5 ± 5.8	114.7 ± 6.2	67.0 ± 4.6	69.3 ± 4.3
12	147.0 ± 8.0	149.4 ± 6.5	38.2 ± 6.9	40.1 ± 6.8	77.5 ± 4.5	78.9 ± 4.0	118.4 ± 7.2	120.6 ± 5.6	69.7 ± 4.7	71.6 ± 4.0
13	153.4 ± 8.8	152.7 ± 5.7	42.4 ± 7.9	44.0 ± 6.8	80.7 ± 4.9	81.4 ± 3.4	124.0 ± 7.9	123.4 ± 5.1	72.4 ± 5.1	73.5 ± 3.7
14	160.1 ± 7.8	154.8 ± 5.1	48.4 ± 8.0	47.1 ± 6.5	84.0 ± 4.8	82.6 ± 3.0	129.9 ± 7.1	125.1 ± 4.5	75.6 ± 4.7	74.2 ± 3.8
15	164.2 ± 6.2	155.4 ± 4.9	53.2 ± 7.0	49.3 ± 5.8	87.1 ± 4.1	83.1 ± 2.8	133.6 ± 5.8	125.8 ± 4.4	77.9 ± 4.7	74.4 ± 3.5
16	166.5 ± 5.8	155.9 ± 5.1	56.2 ± 6.7	50.0 ± 5.8	88.9 ± 3.6	83.6 ± 2.9	135.4 ± 5.5	126.4 ± 4.6	78.9 ± 4.6	74.6 ± 3.4
17	167.0 ± 5.6	155.8 ± 2.8	57.1 ± 6.2	50.8 ± 5.4	89.6 ± 3.4	83.6 ± 2.7	136.0 ± 5.3	126.2 ± 4.4	78.9 ± 4.6	74.5 ± 3.4
18	167.9 ± 5.7	156.2 ± 4.8	59.1 ± 6.4	51.8 ± 5.6	90.1 ± 3.2	83.9 ± 2.6	136.6 ± 5.3	126.8 ± 4.4	78.2 ± 4.3	74.9 ± 3.5
19	168.3 ± 5.5	156.4 ± 5.4	59.7 ± 6.3	51.8 ± 5.8	90.5 ± 3.0	84.0 ± 2.8	137.0 ± 5.2	126.8 ± 4.4	78.9 ± 4.5	74.4 ± 3.4
20	168.6 ± 5.2	156.0 ± 4.6	60.8 ± 6.1	51.9 ± 5.8	90.9 ± 2.9	84.0 ± 2.9	137.6 ± 4.9	126.6 ± 4.1	79.6 ± 4.3	73.5 ± 3.0
21 - 25	167.7 ± 5.4	155.4 ± 5.2	60.8 ± 6.7	51.2 ± 6.0	90.6 ± 2.8	83.6 ± 2.9	137.1 ± 4.9	126.0 ± 4.8	79.2 ± 4.4	73.5 ± 3.6
26 - 30	166.6 ± 5.4	155.2 ± 4.7	61.7 ± 7.6	51.6 ± 6.1	90.1 ± 3.0	84.3 ± 2.8	136.2 ± 5.1	126.1 ± 4.2	77.9 ± 4.3	73.3 ± 3.4
31 - 35	167.9 ± 5.4	154.5 ± 4.9	64.5 ± 7.9	53.0 ± 6.7	90.8 ± 2.8	83.9 ± 2.8	137.3 ± 5.1	125.7 ± 4.5	78.6 ± 4.8	72.9 ± 3.7
36 - 40	166.8 ± 5.5	154.9 ± 5.2	65.1 ± 7.7	54.5 ± 6.6	90.0 ± 3.1	84.0 ± 2.9	136.4 ± 5.1	126.0 ± 4.6	76.9 ± 4.4	73.5 ± 3.4
41 - 50	165.8 ± 5.5	154.7 ± 4.6	65.2 ± 8.3	58.2 ± 6.8	89.4 ± 3.2	83.7 ± 2.8	135.1 ± 5.3	125.8 ± 5.6	76.0 ± 4.5	73.4 ± 3.9
51 -	166.2 ± 3.6	159.0 ± 5.3	61.5 ± 4.4	53.8 ± 9.6	89.7 ± 1.9	82.0 ± 3.2	134.7 ± 3.3	122.6 ± 5.4	74.6 ± 3.7	68.8 ± 3.8

TABLE III. ANATOMICAL CIRCUMFERENCE VALUES AS A FUNCTION OF AGE AND SEX (cm)

Age (Months)	Chest		Abdomen		Head		Neck		Hip	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
36 - 41	51.6 ± 2.8	49.9 ± 1.6	48.8 ± 3.5	48.4 ± 2.9	49.5 ± 1.7	48.9 ± 1.1	24.1 ± 1.6	23.9 ± 1.1	52.5 ± 3.1	52.8 ± 2.4
42 - 47	51.9 ± 1.7	51.0 ± 1.3	49.2 ± 2.3	48.7 ± 2.4	50.3 ± 1.8	49.0 ± 1.1	24.3 ± 1.2	24.2 ± 1.1	53.1 ± 2.0	53.7 ± 2.4
48 - 53	53.4 ± 2.3	52.3 ± 2.3	50.0 ± 2.6	49.7 ± 3.2	50.4 ± 1.4	49.6 ± 1.7	24.9 ± 1.1	24.3 ± 1.2	54.5 ± 2.7	54.8 ± 2.7
54 - 59	54.6 ± 2.8	53.0 ± 2.7	51.2 ± 3.4	50.6 ± 3.5	50.7 ± 1.5	49.8 ± 1.5	25.3 ± 1.3	24.3 ± 1.3	55.9 ± 3.3	56.0 ± 3.0
60 - 65	54.7 ± 2.4	53.7 ± 2.4	51.3 ± 3.2	51.2 ± 3.5	50.9 ± 1.3	50.1 ± 1.3	25.2 ± 1.2	24.6 ± 1.2	56.4 ± 3.0	56.8 ± 3.3
66 - 71	55.9 ± 2.6	54.5 ± 2.6	52.0 ± 3.2	51.7 ± 3.6	51.3 ± 1.4	50.4 ± 1.3	25.3 ± 1.3	24.7 ± 1.2	57.6 ± 3.2	57.8 ± 3.5
6	57.1 ± 2.9	55.4 ± 2.8	54.5 ± 3.2	54.0 ± 3.2	51.3 ± 1.3	50.5 ± 1.4	25.6 ± 1.2	25.0 ± 1.3	59.0 ± 3.4	58.9 ± 3.2
7	58.9 ± 2.9	56.7 ± 3.1	55.5 ± 3.3	55.4 ± 3.9	51.9 ± 1.3	50.6 ± 1.4	26.1 ± 1.2	25.2 ± 1.3	61.4 ± 3.7	60.8 ± 3.7
8	60.9 ± 3.4	58.0 ± 3.4	57.2 ± 3.9	56.6 ± 3.8	52.0 ± 1.4	51.0 ± 1.4	26.6 ± 1.3	25.7 ± 1.4	63.7 ± 4.3	62.9 ± 4.0
9	62.3 ± 3.6	60.8 ± 4.2	58.6 ± 4.1	59.4 ± 4.9	52.2 ± 1.4	51.5 ± 1.4	27.1 ± 1.3	26.6 ± 1.7	65.7 ± 4.3	66.3 ± 4.8
10	64.7 ± 3.9	64.0 ± 5.0	60.8 ± 4.2	62.0 ± 4.5	52.6 ± 1.4	52.2 ± 1.4	27.7 ± 1.4	27.2 ± 1.6	68.3 ± 4.5	69.7 ± 4.9
11	66.6 ± 4.0	67.4 ± 5.6	62.1 ± 4.2	64.3 ± 5.1	52.8 ± 1.5	52.5 ± 1.5	28.3 ± 1.7	27.9 ± 1.7	70.4 ± 4.8	72.9 ± 5.7
12	69.8 ± 5.7	72.4 ± 6.2	64.7 ± 5.7	68.3 ± 5.8	53.2 ± 1.5	53.0 ± 1.5	29.6 ± 2.1	28.5 ± 2.0	74.5 ± 6.1	78.2 ± 6.0
13	72.5 ± 5.9	75.3 ± 5.9	65.7 ± 5.4	70.8 ± 6.0	53.6 ± 1.6	53.5 ± 1.4	30.7 ± 2.3		77.4 ± 6.1	82.0 ± 5.7
14	76.5 ± 5.6	78.0 ± 5.6	68.5 ± 5.2	73.1 ± 5.7	54.2 ± 1.5	53.9 ± 1.4	32.0 ± 2.4		81.4 ± 5.9	84.6 ± 5.1
15	79.8 ± 5.0	79.8 ± 5.0	69.7 ± 4.3	73.6 ± 5.2	54.5 ± 1.5	54.0 ± 1.4	33.0 ± 1.9		84.3 ± 4.8	86.7 ± 4.2
16	82.3 ± 4.4	80.5 ± 5.0	71.0 ± 3.9	74.4 ± 5.0	55.0 ± 1.5	54.0 ± 1.4	33.7 ± 1.8		86.1 ± 4.3	87.2 ± 4.3
17	83.1 ± 4.3	81.7 ± 5.0	71.2 ± 3.7	75.1 ± 5.3	55.0 ± 1.5	54.0 ± 1.3	34.1 ± 1.6		86.5 ± 3.8	87.9 ± 4.0
18	85.0 ± 4.6	82.5 ± 5.0	72.7 ± 4.1	75.9 ± 5.1	55.8 ± 1.5	54.3 ± 1.3	34.9 ± 1.6		87.5 ± 4.0	88.3 ± 4.0
19	85.7 ± 4.3	82.3 ± 4.9	73.4 ± 4.2	75.5 ± 5.4	55.8 ± 1.5	54.2 ± 1.3	35.0 ± 1.6		87.9 ± 3.9	88.3 ± 4.1
20	86.7 ± 4.5	82.4 ± 4.6	74.8 ± 3.9	75.3 ± 4.7	55.6 ± 1.5	54.2 ± 1.3	35.1 ± 1.5		88.6 ± 3.5	88.4 ± 3.6
21 - 25	87.3 ± 4.5	82.4 ± 5.0	75.6 ± 4.8	75.2 ± 5.4	55.9 ± 1.4	54.3 ± 1.3	35.4 ± 1.6		88.8 ± 4.0	87.8 ± 4.2
26 - 30	89.1 ± 5.1	82.8 ± 5.2	78.5 ± 6.1	77.2 ± 6.1	56.3 ± 1.5	54.4 ± 1.4	35.9 ± 1.8		89.5 ± 4.6	88.7 ± 4.4
31 - 35	90.7 ± 5.6	84.3 ± 6.0	80.9 ± 6.3	78.9 ± 6.7	56.4 ± 1.4	54.4 ± 1.4	35.9 ± 1.8		90.7 ± 4.6	90.0 ± 4.7
36 - 40	91.6 ± 5.6	86.2 ± 5.8	82.7 ± 6.6	81.3 ± 7.3	56.5 ± 1.6	54.6 ± 1.4	36.1 ± 1.9		91.2 ± 4.6	91.0 ± 5.0
41 - 50	92.2 ± 5.8	89.6 ± 6.7	84.1 ± 6.8	85.6 ± 6.9	56.2 ± 1.6	54.8 ± 1.3	36.5 ± 2.0		91.2 ± 4.6	92.9 ± 4.8
51 -	90.8 ± 4.5	88.3 ± 9.9	88.0 ± 6.8	91.0 ± 9.7	56.4 ± 0.9	54.6 ± 1.3	37.8 ± 1.7		93.0 ± 4.3	91.2 ± 6.8

TABLE IV. ANATOMICAL DIMENSIONS AS A FUNCTION OF AGE AND SEX

Age (Months)	Thigh circumference		Waist circumference		Shoulder breadths		Arm lengths (shoulder to wrist)		Head lengths	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
36 - 41	29.7 ± 2.6	31.2 ± 1.7	48.8 ± 3.5	48.4 ± 2.9	26.1 ± 1.5	25.9 ± 1.1	29.8 ± 2.2	28.7 ± 1.7		
42 - 47	30.3 ± 1.1	31.6 ± 2.1	49.2 ± 2.3	48.7 ± 2.4	26.4 ± 1.3	26.4 ± 1.3	30.9 ± 2.3	30.5 ± 1.2		
48 - 53	31.5 ± 2.3	31.9 ± 2.3	50.0 ± 2.6	49.7 ± 3.2	27.5 ± 1.8	27.2 ± 2.0	32.5 ± 1.7	31.6 ± 1.8		
54 - 59	32.5 ± 2.4	32.6 ± 2.6	51.2 ± 3.4	50.6 ± 3.5	28.3 ± 2.1	27.9 ± 2.0	33.3 ± 2.1	32.9 ± 1.9		
60 - 65	32.5 ± 2.6	33.3 ± 2.5	51.3 ± 3.2	51.2 ± 3.5	28.4 ± 2.0	28.7 ± 1.9	34.2 ± 2.1	33.8 ± 1.9		
66 - 71	33.2 ± 2.4	34.0 ± 2.6	52.0 ± 3.2	51.7 ± 3.6	29.4 ± 2.1	29.4 ± 1.9	35.3 ± 1.9	34.7 ± 1.8		
6	33.7 ± 2.7	34.1 ± 2.6	51.7 ± 3.1	50.3 ± 3.4	30.6 ± 2.1	30.9 ± 1.7	36.9 ± 2.1	36.3 ± 2.0	16.7 ± 0.8	16.5 ± 0.8
7	35.0 ± 2.8	35.4 ± 2.7	52.9 ± 3.2	51.5 ± 3.7	31.4 ± 2.2	31.8 ± 1.9	38.6 ± 2.1	37.4 ± 2.1	16.9 ± 0.7	16.5 ± 0.7
8	36.9 ± 3.5	36.6 ± 3.1	54.5 ± 4.1	52.5 ± 3.7	32.2 ± 2.3	32.9 ± 1.9	40.7 ± 2.3	39.6 ± 2.3	16.9 ± 0.7	16.6 ± 0.7
9	38.0 ± 3.4	38.8 ± 3.5	55.7 ± 3.9	54.9 ± 4.8	33.3 ± 2.2	34.3 ± 2.3	42.3 ± 2.4	41.5 ± 2.3	17.0 ± 0.7	16.8 ± 0.7
10	39.9 ± 3.6	40.4 ± 3.6	57.5 ± 4.1	56.2 ± 4.1	34.4 ± 2.4	35.8 ± 2.6	43.9 ± 2.8	43.5 ± 2.6	17.1 ± 0.7	17.0 ± 0.7
11	41.1 ± 3.9	42.2 ± 3.9	58.7 ± 4.2	58.1 ± 4.7	35.4 ± 2.3	37.1 ± 2.2	45.4 ± 2.8	45.5 ± 2.9	17.1 ± 0.7	16.9 ± 0.6
12	43.4 ± 4.7	45.2 ± 4.5	61.6 ± 5.7	60.1 ± 5.0	37.1 ± 2.9	39.0 ± 2.3	47.8 ± 3.3	48.1 ± 2.6	17.2 ± 0.7	17.0 ± 0.7
13	44.7 ± 4.4	47.2 ± 4.3	62.7 ± 5.2	61.6 ± 5.2	38.7 ± 2.9	40.2 ± 2.2	49.9 ± 3.5	49.2 ± 2.7	17.3 ± 0.7	17.1 ± 0.6
14	47.1 ± 4.4	49.2 ± 4.2	65.4 ± 5.3	63.3 ± 5.1	40.4 ± 3.0	40.8 ± 2.1	52.2 ± 3.2	49.9 ± 2.3	17.5 ± 0.7	17.2 ± 0.7
15	48.7 ± 3.9	50.5 ± 3.6	67.0 ± 4.3	64.1 ± 4.7	41.7 ± 2.5	41.2 ± 2.0	53.7 ± 2.6	50.1 ± 2.2	17.6 ± 0.7	17.3 ± 0.7
16	49.8 ± 3.6	50.7 ± 3.5	68.7 ± 4.0	64.6 ± 4.6	42.3 ± 2.4	41.4 ± 1.9	54.7 ± 2.5	50.1 ± 2.2	17.8 ± 0.8	17.3 ± 0.6
17	49.9 ± 3.2	51.2 ± 3.2	69.0 ± 3.9	65.2 ± 4.7	42.3 ± 2.4	41.7 ± 1.9	54.7 ± 2.5	49.9 ± 2.1	17.8 ± 0.8	17.3 ± 0.7
18	50.7 ± 3.4	51.2 ± 3.2	70.4 ± 4.2	65.9 ± 4.4	43.1 ± 2.3	41.8 ± 2.0	54.9 ± 2.5	50.3 ± 2.1	17.8 ± 0.8	17.4 ± 0.6
19	50.7 ± 3.3	51.1 ± 3.0	71.3 ± 4.3	65.1 ± 4.6	43.3 ± 2.4	41.5 ± 2.0	55.1 ± 2.5	50.5 ± 2.5	17.8 ± 0.8	17.5 ± 0.6
20	51.0 ± 3.3	51.3 ± 2.8	72.8 ± 4.0	64.9 ± 4.1	43.6 ± 2.3	41.2 ± 1.9	55.5 ± 2.2	50.6 ± 2.4	17.9 ± 0.7	17.4 ± 0.7
21 - 25	51.2 ± 3.6	50.6 ± 3.3	73.7 ± 5.0	64.8 ± 4.5	43.2 ± 2.4	40.7 ± 1.9	55.3 ± 2.3	50.4 ± 2.3	18.0 ± 0.7	17.4 ± 0.6
26 - 30	51.4 ± 4.0	50.6 ± 3.7	76.9 ± 6.5	67.4 ± 6.2	42.8 ± 2.4	41.0 ± 1.8	55.5 ± 2.3	50.0 ± 2.0	18.1 ± 0.7	17.5 ± 0.6
31 - 35	52.6 ± 3.9	51.1 ± 3.6	79.8 ± 6.7	69.4 ± 6.2	43.3 ± 2.1	41.0 ± 2.0	54.6 ± 2.4	50.1 ± 2.1	18.3 ± 0.7	17.5 ± 0.6
36 - 40	52.7 ± 3.5	51.7 ± 3.4	81.8 ± 7.4	71.7 ± 6.7	43.0 ± 2.5	41.1 ± 2.0	54.4 ± 2.2	50.1 ± 2.0	18.4 ± 0.6	17.6 ± 0.6
41 - 50	51.7 ± 3.6	52.2 ± 3.4	83.2 ± 7.2	76.4 ± 6.8	42.9 ± 2.2	41.7 ± 1.9	54.1 ± 2.0	50.5 ± 1.9	18.3 ± 0.6	17.7 ± 0.6
51 -	50.9 ± 3.3	48.8 ± 4.7	86.5 ± 7.8	81.4 ± 12.1	43.2 ± 1.8	39.0 ± 2.7	56.7 ± 1.6	49.6 ± 2.0	18.0 ± 0.6	17.8 ± 0.6

TABLE V. ANATOMICAL DIMENSIONS AS A FUNCTION OF AGE AND SEX

Age (Months)	Head Breadths		Head Heights		Hip Breadths	
	Male	Female	Male	Female	Male	Female
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
6	14.8 ± 0.7	14.4 ± 0.7	20.1 ± 1.5	19.4 ± 1.9	20.1 ± 1.1	20.4 ± 1.1
7	14.9 ± 0.6	14.4 ± 0.6	20.5 ± 1.4	19.8 ± 1.2	20.9 ± 1.3	21.1 ± 1.3
8	15.0 ± 0.6	14.4 ± 0.7	20.5 ± 2.3	20.1 ± 1.4	21.8 ± 1.4	21.9 ± 1.4
9	15.0 ± 0.6	14.6 ± 0.6	21.0 ± 1.5	20.5 ± 1.6	22.6 ± 1.4	23.0 ± 1.6
10	15.1 ± 0.6	14.7 ± 0.6	21.1 ± 1.5	20.7 ± 1.5	23.6 ± 1.5	24.3 ± 1.7
11	15.2 ± 0.6	14.8 ± 0.6	21.3 ± 1.7	21.2 ± 1.5	24.3 ± 1.6	25.3 ± 2.2
12	15.3 ± 0.6	14.9 ± 0.6	21.7 ± 1.9	21.2 ± 1.8	25.6 ± 2.1	27.6 ± 2.2
13	15.4 ± 0.6	15.0 ± 0.6	21.8 ± 2.2	21.3 ± 1.6	27.0 ± 2.1	29.0 ± 2.0
14	15.6 ± 0.6	15.1 ± 0.6	22.2 ± 2.4	21.6 ± 1.4	28.5 ± 2.2	29.9 ± 1.8
15	15.6 ± 0.6	15.0 ± 0.6	22.3 ± 1.9	21.1 ± 1.6	29.4 ± 1.7	30.6 ± 1.5
16	15.7 ± 0.6	15.0 ± 0.6	22.5 ± 1.9	21.0 ± 1.4	30.0 ± 1.4	30.9 ± 1.4
17	15.8 ± 0.6	15.0 ± 0.5	22.4 ± 1.7	20.9 ± 1.3	30.1 ± 1.4	31.1 ± 1.4
18	15.8 ± 0.6	15.0 ± 0.6	22.7 ± 1.8	20.8 ± 1.5	30.4 ± 1.5	31.2 ± 1.4
19	15.8 ± 0.6	15.0 ± 0.5	22.6 ± 1.8	20.8 ± 1.2	30.5 ± 1.4	31.4 ± 1.3
20	15.8 ± 0.6	15.1 ± 0.6	22.2 ± 1.8	21.0 ± 2.5	30.6 ± 1.3	31.4 ± 1.4
21 - 25	15.9 ± 0.6	15.1 ± 0.6	22.2 ± 1.8	21.0 ± 1.1	30.6 ± 1.4	31.2 ± 1.5
26 - 30	15.9 ± 0.6	15.0 ± 0.6	22.3 ± 1.7	21.2 ± 1.1	30.7 ± 1.5	31.1 ± 1.3
31 - 35	16.1 ± 0.6	14.9 ± 0.6	22.2 ± 1.3	21.1 ± 1.1	31.3 ± 1.6	31.3 ± 1.7
36 - 40	16.0 ± 0.6	15.0 ± 0.7	22.6 ± 1.4	21.2 ± 1.1	31.2 ± 1.5	31.6 ± 1.7
41 - 50	16.1 ± 0.6	15.0 ± 0.7	22.3 ± 1.1	21.4 ± 1.8	31.1 ± 1.7	31.8 ± 1.4
51 -	16.3 ± 0.6	15.0 ± 0.6	22.8 ± 1.7	21.1 ± 1.7	31.8 ± 1.5	31.4 ± 1.5

TABLE VI. SURFACE AREAS AS A FUNCTION OF AGE AND SEX

Age (Months)	Male	Female
	Mean	Mean
36 - 41	6452.2	6210.1
42 - 47	6610.5	6591.8
48 - 53	6989.4	6892.8
54 - 59	7330.9	7111.8
60 - 65	7518.5	7443.6
66 - 71	7786.8	7661.7
6	8247.0	8128.4
7	8800.3	8544.5
8	9496.7	9150.2
9	10046.9	9987.5
10	10796.3	10814.4
11	11054.9	11680.3
12	12530.1	12940.5
13	13485.4	13704.6
14	14718.2	14277.0
15	15627.5	14633.9
16	16174.5	14761.8
17	16326.3	14874.0
18	16656.2	15039.3
19	16759.7	15048.9
20	16760.6	15044.3
21 - 25	16882.3	14918.0
26 - 30	16952.0	14961.9
31 - 35	17399.3	15129.6
36 - 40	17422.1	15361.6
41 - 50	17384.9	15865.3
51 -	16903.6	15020.4

TABLE VII. COMPARATIVE DATA OF THE PHYSICAL STANDARDS ACCORDING TO THE AGE (MALE)

Present Data						Korean Institute for Science and Technology					
Age	Stature	Weight	Chest Circ.	Waist Circ.	Neck Circ.	Age	Stature	Weight	Chest Circ.	Waist Circ.	Neck Circ.
6	117.0	20.8	57.1	51.7	25.6	6	113.9	19.7	57.0	52.5	26.7
7	121.5	22.8	58.1	52.9	26.1	7	119.1	21.3	58.4	52.6	26.3
8	126.5	25.5	60.3	54.5	26.6	8	124.4	24.0	62.4	53.9	26.9
9	131.3	27.7	62.3	55.7	27.1	9	129.5	26.7	61.9	55.3	27.6
10	135.8	30.7	64.3	57.5	27.7	10	133.3	29.1	65.0	56.9	28.1
11	140.4	33.4	66.6	58.7	28.3	11	138.3	32.6	67.4	58.5	28.8
12	147.0	38.2	69.8	61.6	29.6	12	142.6	34.7	69.3	59.8	29.4
13	153.4	42.4	72.5	62.7	30.7	13	149.8	40.1	73.1	62.8	30.4
14	160.1	48.4	76.5	65.4	32.0	14	156.7	45.6	76.5	64.8	31.6
15	164.2	53.2	79.8	67.0	33.0	15	161.8	50.3	80.1	66.9	32.7
16	166.2	56.2	82.3	68.7	33.7	16	165.5	54.3	82.5	68.4	33.5
17	167.0	57.1	83.1	69.0	34.1	17	167.6	56.7	84.5	69.7	34.0
18	167.9	59.1	85.0	70.4	34.9	18-19	166.8	58.8	87.1	72.2	34.7
19	168.3	59.7	85.7	71.3	35.0	20-24	167.7	61.3	89.0	74.5	35.3
20	168.6	60.8	86.7	72.8	35.1	25-29	167.0	61.7	90.3	75.0	35.8
21-25	167.7	60.8	87.3	73.7	35.4	30-34	166.1	60.8	89.8	75.9	35.7
26-30	166.6	61.7	89.1	76.9	35.9	35-39	166.0	62.2	91.7	75.5	36.2
31-35	167.6	64.5	90.7	79.8	35.9	40-44	164.9	61.7	91.5	77.7	36.1
36-40	166.8	65.1	91.6	81.8	36.1	45	162.9	56.7	87.8	74.4	35.4
41-50	165.8	65.2	92.2	83.2	36.5						

TABLE VIII. COMPARATIVE DATA OF THE PHYSICAL STANDARDS ACCORDING TO THE AGE (FEMALE)

Present Data						Korean Institute for Science and Technology					
Age	Stature	Weight	Chest Circ.	Waist Circ.	Neck Circ.	Age	Stature	Weight	Chest Circ.	Waist Circ.	Neck Circ.
6	116.4	20.3	55.4	50.3	25.0	6	112.5	19.1	56.4	51.2	26.0
7	119.8	21.3	56.7	51.5	25.2	7	116.9	20.5	57.3	51.1	26.2
8	125.3	23.9	58.0	52.5	25.7	8	124.1	23.6	59.6	52.4	26.5
9	131.2	27.2	60.8	54.9	26.6	9	127.5	25.4	61.8	53.3	27.1
10	136.7	30.6	64.0	56.2	27.2	10	133.8	28.8	64.2	55.2	27.9
11	142.7	34.2	67.4	58.1	27.9	11	139.6	32.3	66.8	56.9	28.5
12	149.4	40.1	72.4	60.1	33.7	12	145.2	36.8	71.0	58.4	29.6
13	152.7	44.0	75.3	61.6	34.5	13	149.3	40.9	74.6	60.6	30.4
14	154.8	47.1	78.0	63.3	35.3	14	152.3	44.6	77.6	62.3	31.1
15	155.4	49.3	79.8	64.1	35.3	15	154.6	48.5	81.2	64.7	32.0
16	155.9	50.0	80.5	64.6	35.4	16	155.2	51.0	83.0	65.9	32.4
17	155.8	50.8	81.7	65.2	35.6	17	155.5	51.4	83.6	66.5	32.5
18	156.2	51.8	82.5	65.9	35.8	18-19	155.7	53.0	85.5	67.6	33.3
19	156.4	51.8	82.3	65.1	35.7	20-24	155.5	52.7	85.6	67.9	33.4
20	156.0	51.9	82.4	64.9	35.8	25-29	155.2	51.0	84.8	68.0	35.3
21-25	155.4	51.2	82.4	64.8	35.7	30-34	153.7	51.9	85.4	70.1	34.7
26-30	155.2	51.6	82.8	67.4	35.7	35-39	154.2	52.4	86.7	72.0	35.7
31-35	154.5	53.0	84.3	69.4	36.2	40-44	154.3	53.7	88.0	73.7	34.4
36.40	154.9	54.5	86.2	71.7	36.2	45	151.9	53.0	88.4	74.9	36.2
41-50	154.9	58.2	89.6	76.4	36.8						

TABLE IX. AVERAGE WEIGHT OF ORGANS OF THE KOREAN FEMALE AS COMPARED WITH THE DATA IN LITERATURES MASS UNIT: GRAM

Organ	Reference Korean (Present work)		Korean[9] (Lee & Roh)		Reference[3] Japanese		Reference man[2]	
	n	Mean value	n	Mean value	n	Mean value	n	Mean value
Adrenal gland								
Left	-	-	34	5.0	247	6.85	277	12.7 ±
Right	-	-	33	5.2	248	6.36		
Brain	307	-	87	1,231.6	197	1,308.00	1,330	1,220.0
Heart	364	301.6	118	220.7	181	284	-	275(240) ± ±
Kidney								
Left	363	114.2	118	117.1	183	145	1,014	275 ±
Right	362	113.5	12	115.9	184	135		
Liver	362	1,610.9	111	1,146.4	174	1,363	44	1,477
Lung								
Left	357	435.7	74	331.4	152	415	150	886 ±
Right	354	512.7	73	339.6	155	478		
Pancreas	250	54.0	52	85.5	218	111	79	84.8
Spleen	363	58.2	91	99.5	195	122	720	153
Thyroid gland	-	-	26	21.9	241	16.8	144	14.5

± Both organs
± ± Ref.

TABLE IX. AVERAGE WEIGHT OF ORGANS OF THE KOREAN FEMALE AS COMPARED WITH THE DATA IN LITERATURES MASS UNIT: GRAM

Organ	Reference Korean (Present work)		Korean[9] (Lee & Roh)		Reference[3] Japanese		Reference man[2]	
	n	Mean value	n	Mean value	n	Mean value	n	Mean value
Adrenal gland								
Left	-	-	34	5.0	247	6.85	277	12.7 ±
Right	-	-	33	5.2	248	6.36		
Brain	307	-	87	1,231.6	197	1,308.00	1,330	1,220.0
Heart	364	301.6	118	220.7	181	284	-	275(240) ± ±
Kidney								
Left	363	114.2	118	117.1	183	145	1,014	275 ±
Right	362	113.5	12	115.9	184	135		
Liver	362	1,610.9	111	1,146.4	174	1,363	44	1,477
Lung								
Left	357	435.7	74	331.4	152	415	150	886 ±
Right	354	512.7	73	339.6	155	478		
Pancreas	250	54.0	52	85.5	218	111	79	84.8
Spleen	363	58.2	91	99.5	195	122	720	153
Thyroid gland	-	-	26	21.9	241	16.8	144	14.5

± Both organs
± ± Ref.

TABLE X. AVERAGE WEIGHT OF ORGANS OF THE KOREAN MALE AS COMPARED WITH THE DATA IN LITERATURES MASS UNIT: GRAM

Organ	Reference Korean (Present work)		Korean[9] (Lee & Roh)		Reference[3] Japanese		Reference man[2]	
	n	Mean value	n	Mean value	n	Mean value	n	Mean value
Adrenal gland								
Left	-	-	112	5.0	1,127	7.65	328	13.8 ±
Right	-	-	112	5.0	1,189	7.03		
Brain	789	-	305	1,369.0	918	1,440.00	2,107	1,355.0
Heart	928	348.8	384	252.1	596	352	309	345(330) ± ±
Kidney								
Left	928	126.0	392	126.2	868	168	2,414	310 ±
Right	926	125.6	339	122.0	876	159		
Liver	920	1,863.9	328	1,211.6	856	1,600	150	1,831
Lung								
Left	885	548.8	123	369.0	715	539	259	1,169
Right	926	652.6	99	393.8	722	623		
Pancreas	659	56.4	227	89.7	1.17	135	131	96.1
Spleen	928	67.3	324	107.3	867	127	1,022	192
Thyroid gland	-	-	81	18.3	1,185	17.1	528	34.7

± Both organs
± ± Ref.2

and 577 in female) [8]. We cited the data in this report because of the insufficiency of the new data collected.

RESULTS AND DISCUSSION

Committee II of ICRP and NIRS of Japan has published extensive information on the anatomical, chemical and physiological standard of a Caucasian and Japanese as a Reference Man and Reference Japanese, respectively, for the purpose of estimation of internal exposure. However, the human models such as a Reference Man or Reference Japanese are based on the data obtained from Caucasians and Japanese. The Reference Man or Reference Japanese are not directly applicable to Koreans since the differences exist among Asians, Europeans and Americans with respect to races, customs and the patterns of food consumption.

In view of those problems, it is necessary obtain reference values for Korean, such as a physical standard, food consumption and mass or dimension of internal organs of individuals in Korea. We, therefore, collected the data on physical standards of Korean and compared them with those of former data [4], for the first year, in order to establish the Reference Korean.

First, the stature of Koreans was increased but the circumference was decreased when they are compared with those of 1979. These might be caused by the change of nutritional value and social behavior. Second, the physical values of females around 10 years old were greater than those of males with same age but it was reverted beyond the ages. This might be caused by the difference of onset age of the sexual maturation. Third, the size of head was invariable all over the ages. Fourth, the determination of body surface area is not easy whereas it is an important one for the evaluation of radiation exposure. Many methods to calculate the surface area of human beings have been developed [7, 9-11]. We adapted the method of Du Bois and Du Bois [7]. Finally, we compared these data with those of Reference Man and Reference Japanese. The values of Reference Korean were similar to those of Reference Japanese but different with those of Reference Man. The physical standards of Reference Korean and Reference Japanese were similar to those of Caucasians who are aged around 15. Since the values of Reference Korean are similar to those of Reference Japanese, the establishment of Reference Asian may be possible.

On the other hand, mass of internal organ was cited from the data of former report which was prepared by us because of the insufficiency of the new data. The mass of Korean organs is similar to that of Japanese, but the weights of liver and pancreas were different with those of Japanese. This might be caused by the difference of the criterion of weighing methods but not by the real difference.

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