방사선 방어학회지
제 8권 제 1호 1983

<Original>

Studies on the Reference Korean

2. Mass of Organs and Size of Brains

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Abstract

For the purpose of prediction and protection of radiation effects on the Korean people, we have collected autoptic data from the National Institute of Scientific Investigation. The mass of organs and the size of brains measured is analysed for 1,921 Korean people. The results obtained are as follows;

1. The weight of the kidney in the Reference Korean is 251.6g in male and 227.7g in female.
2. The weight of the lung in the Reference Korean is 1,204.4g in male and 957.4g in female.
3. The weight of the heart in the Reference Korean is 348.8g in male and 301.6g in female.
4. The weight of the liver in the Reference Korean is 1,863.9g in male and 1,610.9g in female.
5. The weight of the pancreas in the Reference Korean is 56.4g in male and 54.0g in female.
6. The weight of the spleen in the Reference Korean is 67.3g in male and 58.2g in female.
7. The anteroposterior diameter, transverse diameter and vertical diameter of the brain in the Reference Korean are 17.6cm, 15.5cm and 8.6cm in male, respectively, and 17.7cm, 15.4cm and 8.2cm in female, respectively.

Introduction

There are two ways in the exposure of radiation. One is the external exposure to the cosmic ray, environmental radiation and radiation released directly from nuclear facilities, and the other is the internal exposure to radiation released from natural or man-made radioactive substances inhaled or ingested through inhalation, and food chains.

Since radiation is known as a strong mutagen and one of the main factors to induce life shortening in animals, there has been a strong effort to establish the tolerable degree of maximum permissible exposure dose of radiation. Such maximum permissible exposure dose is applicable to man directly in case of external exposure but quantitative data about the behaviour 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 supplimentary 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. In our laboratory, the project on the Reference Korean was planned in 1980 and it is in progress now. We have carried out the data collection on the body length, body weight, body surface area, pattern of food consumption and the quantity of daily intake of radioactive substances, and the results are reported.[4] The present report is concerned with the internal organs of the Reference Korean.

Methods

In order to determine the mass of Korean internal organs, we have collected autoptic data from the National Institute of Scientific Investigation. The autoptic data were collected from 2,018 people who died in a sudden accident for three years, from 1971 to 1981. However, the data only for 1,921 (1,344 in male 577 in female) out of 2,018 people were analysed for the determination of mass of organs. The difference between the collected data and analysed was due to incorrected data which were caused by spoilage of corpses or by abnormal man. The age and sex distribution are shown in Table 1.

Table 1. Number of people surveyed for analysing the mass of organs in the Korean

Age Group (years)	No. of Samples	
	M	F
0— 4	16	13
5— 8	11	9
9—12	11	8
13—16	46	31
17—20	168	80
21—25	209	118
26—30	183	77
31—35	138	60
36—40	178	58
41—45	131	31
46—50	89	22
51—55	56	25
56—60	63	21
61—	45	24
Subtotal	1,344	577
Total	1,921	

The kinds or organs measured were kidney, lung, heart, liver, pancreas, spleen and brain. All of the data collected were divided into small groups according to the age and sex. The average and relative weight were analysed for each group. The relative weight was obtained by dividing the mass of organ with total body weight of that age group.[4] All the data analysis was performed by the Cyber-135 computer. In the mass of organs the age group of the Reference Korean is 20 to 50 years old in both sexes.

Results and Discussion

1) Weight of the kidney

The kidney is an organ through which internal waste materials are excreted and if some radioactive substances are absorbed by the inhalation or ingestion, most of them come to be excreted through this organ.

Because of this reason, this organ might be in danger considerably when radioactive substance of which the physical half life is longer than the biological one is absorbed.

As shown in Table 2 and 3, the weight of the kidney in the Reference Korean is 251.6g in male and 227.7g in female. These values are similar to the data from Lee, et al.,[5] but lower value is found compared to those in the Reference Japanese and the Reference Man.

Besides, the weight of the kidney in the Japanese is very similar to that in the Reference Man and the weight of their right kidney is the same as left one but the right kidney is a little larger than the left one in the Korean, and such phenomenon

Table 2. Average weight of organs of the Korean female as compared with the data in literatures

mass unit: gram

Organ	Reference Korean (Present work)		Korean[5] (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	1,330	1,220
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	521.7	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 organ ** Ref. 2

Table 3. Average weight of organs of the Korean male as compared with the data in literatures

mass unit: gram

Organ	Reference Korean (Present work)		Korean[5] (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	786	—	305	1,369.0	918	1,440	2,107	1,355
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	1600	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 organ ** Ref. 2

Table 4. Weight of the left kidney and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	13	33.1	11.8	2.756	0.985
5 — 8	9	55.5	15.1	2.908	0.790
9 — 12	8	68.7	11.2	2.299	0.376
13 — 16	31	101.9	17.9	2.275	0.401
17 — 20	78	107.4	13.5	2.027	0.255
21 — 25	115	111.8	12.6	2.146	0.241
26 — 30	77	112.0	12.6	2.197	0.247
31 — 35	60	116.1	16.3	2.238	0.315
36 — 40	58	117.5	13.5	2.244	0.258
41 — 45	31	117.0	15.9	2.160	0.294
46 — 50	22	116.8	25.7	2.199	0.484
51 — 55	25	120.8	16.8	2.274	0.316
56 — 60	21	122.3	13.0	2.304	0.244
61 —	24	115.8	11.7	2.181	0.221
Total	572	—	—	—	—

Table 5. Weight of the left kidney and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	16	36.3	17.1	2.900	1.366
5 — 8	11	58.1	9.8	2.953	0.498
9 — 12	11	69.1	11.9	2.374	0.390
13 — 16	46	107.2	18.1	2.350	0.397
17 — 20	168	117.9	18.1	2.004	0.308
21 — 25	209	122.5	17.6	1.998	0.287
26 — 30	183	125.2	16.4	2.029	0.266
31 — 35	138	127.4	20.5	2.106	0.339
36 — 40	178	128.7	17.6	2.069	0.283
41 — 45	131	126.0	19.9	2.043	0.323
46 — 50	89	127.9	16.1	2.257	0.284
51 — 55	56	128.2	18.5	2.261	0.326
56 — 60	63	129.7	22.5	2.287	0.397
61 —	45	128.0	23.4	2.257	0.413
Total	1,344	—	—	—	—

Table 6. Weight of the right kidney and the relative weight of the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	13	33.1	11.8	2.756	0.985
5 — 8	9	55.5	15.1	2.908	0.790
9 — 12	8	67.5	11.6	2.257	0.389
13 — 16	31	101.9	17.9	2.275	0.401
17 — 20	78	107.0	13.3	2.019	0.250
21 — 25	115	110.6	12.5	2.124	0.240
26 — 30	77	112.0	12.6	2.197	0.247
31 — 35	59	113.5	18.0	2.188	0.348
36 — 40	58	117.1	13.3	2.234	0.255
41 — 45	31	116.7	14.6	2.154	0.271
46 — 50	22	120.4	44.1	2.268	0.831
51 — 55	25	120.4	15.6	2.267	0.295
56 — 60	21	122.3	13.0	2.304	0.244
61 —	24	115.4	11.7	2.173	0.221
Total	571	—	—	—	—

Table 7. Weight of the right kidney and the relative weight of the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	16	36.3	17.1	2.900	1.366
5 — 8	11	58.2	9.8	2.953	0.498
9 — 12	11	69.1	11.4	2.374	0.390
13 — 16	45	106.2	17.2	2.329	0.378
17 — 20	167	117.9	18.8	2.005	0.319
21 — 25	209	121.8	16.1	1.986	0.262
26 — 30	183	124.8	16.0	2.021	0.260
31 — 35	138	127.4	19.9	2.106	0.330
36 — 40	177	127.9	17.7	2.057	0.285
41 — 45	130	126.3	17.5	2.047	0.284
46 — 50	89	127.4	19.8	2.247	0.349
51 — 55	57	130.2	16.5	2.296	0.292
56 — 60	63	128.6	20.1	2.268	0.355
61 —	45	127.1	23.8	2.242	0.420
Total	1,341	—	—	—	—

Table 8. Weight of the left lung and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	14	85.0	48.1	7.083	4.013
5 — 8	9	133.3	29.1	6.980	1.526
9 — 12	7	250.0	70.7	8.361	2.364
13 — 16	30	384.3	107.8	8.578	2.407
17 — 20	81	400.9	99.4	7.565	1.877
21 — 25	115	414.9	107.6	7.964	2.066
26 — 30	76	418.6	116.8	8.209	2.290
31 — 35	57	424.9	111.5	8.187	2.148
36 — 40	57	473.1	136.0	9.029	2.505
41 — 45	31	464.5	151.1	8.570	2.789
46 — 50	21	498.0	147.7	9.380	2.781
51 — 55	15	404.8	95.9	7.623	1.806
56 — 60	21	450.9	137.9	8.492	2.597
61 —	24	427.5	96.7	8.050	1.822
Total	568	—	—	—	—

Table 9. Weight of the left lung and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	15	66.0	29.7	5.230	2.377
5 — 8	11	156.3	48.2	7.937	2.448
9 — 12	11	264.5	116.7	9.090	4.012
13 — 16	24	473.8	146.1	10.390	3.205
17 — 20	156	525.0	141.2	8.930	2.402
21 — 25	203	533.1	166.9	8.697	2.723
26 — 30	174	536.6	157.5	8.696	2.553
31 — 35	130	569.5	161.4	9.413	2.668
36 — 40	165	552.7	171.5	8.885	2.757
41 — 45	129	538.1	160.9	8.722	2.607
46 — 50	84	589.2	159.2	10.391	2.808
51 — 55	55	546.5	153.2	9.640	2.701
56 — 60	63	585.9	163.4	10.332	2.881
61 —	93	548.9	154.0	9.682	2.716
Total	1,277	—	—	—	—

Table 10. Weight of the right lung and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	14	101.4	58.0	8.452	4.835
5 — 8	9	151.1	38.5	7.911	2.018
9 — 12	7	337.1	142.1	11.275	4.752
13 — 16	30	462.6	119.1	10.327	2.657
17 — 20	80	488.5	116.1	9.216	2.191
21 — 25	115	502.6	136.5	9.648	2.620
26 — 30	76	495.6	143.4	9.718	2.812
31 — 35	56	516.4	119.2	9.950	2.297
36 — 40	56	561.1	169.3	10.707	3.232
41 — 45	31	577.7	183.8	10.659	3.392
46 — 50	20	547.5	157.6	10.310	2.969
51 — 55	25	479.2	111.2	9.024	2.094
56 — 60	21	554.2	174.2	10.438	3.281
61 —	24	515.0	102.7	9.698	1.934
Total	564	—	—	—	—

Table 11. Weight of the right lung and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	15	78.7	33.1	6.293	2.651
5 — 8	11	187.3	68.4	9.506	3.473
9 — 12	11	310.0	136.4	10.653	4.687
13 — 16	43	545.3	162.6	11.959	3.566
17 — 20	156	616.1	164.7	10.478	2.800
21 — 25	202	629.6	189.0	10.271	3.084
26 — 30	176	640.6	183.9	10.383	2.980
31 — 35	127	673.4	194.5	11.130	3.215
36 — 40	166	661.3	193.9	10.631	3.118
41 — 45	125	648.5	181.4	10.510	2.940
46 — 50	85	690.0	222.9	12.169	3.932
51 — 55	55	653.6	187.0	11.528	3,300
56 — 60	63	704.3	205.9	12.421	3.630
61 —	39	657.4	184.1	11.595	3.247
Total	1,274	—	—	—	—

Table 12. Weight of the heart and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	14	56.4	25.0	4.702	2.083
5 — 8	9	96.6	35.3	5.061	1.851
9 — 12	8	176.2	62.7	5.894	2.099
13 — 16	31	253.2	46.6	5.652	1.041
17 — 20	81	273.8	24.0	5.166	0.452
21 — 25	118	286.5	33.7	5.499	0.647
26 — 30	77	286.6	37.9	5.620	0.744
31 — 35	59	306.9	57.9	5.914	1.116
36 — 40	57	306.3	42.1	5.845	0.802
41 — 45	31	333.8	95.0	6.159	1.753
46 — 50	22	362.7	110.1	6.831	2.074
51 — 55	25	377.6	91.6	7.111	1.726
56 — 60	21	352.8	76.5	6.645	1.441
61 —	24	329.1	66.8	6.198	1.258
Total	577	—	—	—	—

Table 13. Weight of the heart and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	16	50.0	21.3	4.000	1.703
5 — 8	11	108.2	33.7	5.491	1.711
9 — 12	11	138.2	38.7	4.749	1.329
13 — 16	46	271.5	43.3	5.954	0.949
17 — 20	166	303.7	47.2	5.165	0.804
21 — 25	210	329.2	58.2	5.370	0.950
26 — 30	183	336.0	60.8	5.446	0.986
31 — 35	136	344.8	68.8	5.699	1.137
36 — 40	179	365.3	87.1	5.872	1.400
41 — 45	132	357.7	95.1	5.797	1.541
46 — 50	88	381.0	125.9	6.720	2.221
51 — 55	57	375.3	83.8	6.618	1.478
56 — 60	63	393.3	95.9	6.937	1.690
61 —	45	391.3	127.7	6.902	2.253
Total	1,343	—	—	—	—

Table 14. Weight of the liver and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	14	426.4	210.4	35.54	17.54
5 — 8	9	738.8	211.8	38.69	11.09
9 — 12	8	975.0	247.8	32.61	8.29
13 — 16	31	1451.6	207.9	32.40	4.64
17 — 20	81	1556.2	332.9	29.36	6.28
21 — 25	117	1560.8	304.2	29.96	5.84
26 — 30	76	1547.1	351.3	30.33	6.89
31 — 35	59	1629.5	312.8	31.40	6.03
36 — 40	57	1729.7	381.3	33.01	7.28
41 — 45	31	1667.1	374.4	30.76	6.91
46 — 50	22	1660.0	403.7	31.26	7.60
51 — 55	24	1595.8	233.6	30.05	4.40
56 — 60	20	1547.5	340.8	29.14	6.42
61 —	23	1469.6	272.1	27.68	5.12
Total	572	—	—	—	—

Table 15. Weight of the liver and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	16	361.3	194.6	28.90	15.56
5 — 8	11	822.7	169.4	41.76	8.60
9 — 12	11	1000.0	265.5	34.36	9.12
13 — 16	46	1620.7	291.7	35.54	6.40
17 — 20	166	1710.2	319.5	29.08	5.43
21 — 25	211	1853.9	331.1	30.24	5.40
26 — 30	184	1822.0	355.1	29.53	5.76
31 — 35	136	1825.4	389.0	30.17	6.43
36 — 40	173	1893.4	378.6	30.44	6.08
41 — 45	127	1925.9	405.5	31.22	6.57
46 — 50	89	1887.2	431.4	33.28	7.61
51 — 55	56	1746.9	311.3	30.81	5.49
56 — 60	62	1727.9	494.3	30.47	8.72
61 —	46	1730.4	416.5	30.52	7.35
Total	1,334	—	—	—	—

is revealed in the Reference Man,[2] too. The weight of the kidney and the relative weight of the kidney to the total body as a function of age are shown in Table 4 through 7.

2) Weight of the lung

The lung is exposed directly by the radioactive substance inhaled. This organ is very important to estimate the internal exposure dose in man for this reason.

The weight of lung in the Reference Man is 958g in female (left lung-436g, right lung-522g) and 1,202g in male (left lung-549g, right lung-653g), respectively as shown in Table 2 and 3. The ratio of right to left lung is 1.197 in female and 1.189 in male and these values are very similar to those in the Reference Man ranged 1.133-1.210 in female and 1.143-1.167 in male and to those in the Reference Japanese revealed 1.135 in female and 1.156 in male. The weight of lung and the relative weight of lung to the total body as a function of age are shown in Table 8 through 11.

3) Weight of the heart

The weight of heart in case of male is 345g in the Reference Man, 352g in the Reference Japanese and 349g in the Reference Korean, however, the value in case of female in the Reference Korean is higher than those in the Reference Japanese and the Reference Man as shown in Table 2 and 3. The weight of heart and the relative weight of heart to the total body as a function of age are shown in Table 12 and 13.

4) Weight of the liver

The weight of liver in the Reference Korean is higher than those in the Reference Japanese and the Reference Man as shown in Table 2 and 3. Especially, the value in case of female is different from that in the Reference Japanese by 250g and that in the Reference Man by 150g whereas the value in case of male is similar to that in the Reference Man. But the values between the Korean and the Japanese female has a big difference by 250g as in case of male. The weight of liver and the relative weight of liver to the total body as a function of age are shown in Table 14 and 15.

5) Weight of the pancreas

The weight of pancreas in the Reference Korean is very different from those in the Reference Japanese and the Reference Man. As shown in Table 2 and 3, the value in the Reference Japanese is the biggest and the value in the Reference Korean is the smallest among Korean,[5] Japanese and Caucasian. The data from Lee[6] shows also the same result. The weight of pancreas and the relative weight of pancreas to the total body as a function of age are shown in Table 16 and 17.

6) Weight of the spleen

The weight of spleen in the Reference Man is found to be the biggest one and that in the Reference Korean is found to be the smallest one among Korean, Japanese and Caucasian. Especially, the spleen is well known to be closely related to the body weight, and therefore, Spencer et al.,[7] formulated the relationship between the weight of the spleen and the total body weight. The formula is as follows.

$$\log s = \log^{3.5} + 0.97 \log^{w}$$

where, S means weight of the spleen (g)

W means weight of the body (Kg)

The weight of spleen and the relative weight to the total body as a function of age are shown in Table 18 and 19.

7) Size of the brain

The size of brain in the Reference Korean is 17.8cm between front and back, 15.5cm between left and right, 8.6cm between up and down in male, and 17.7cm, 15.4cm and 8.2cm in female, respectively.

The length of the brain between up and down in the Reference Korean is lower but the rest sizes of the brain is higher than those in the Reference Man. This result indicates that the weight of brain between the Korean and the Caucasian presumed to be the same each other. According to the data from Lee, et al.,[5] the Korean brain value is lower than

Table 16. Weight of the pancreas and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	7	18.57	7.48	1.548	0.623
5 — 8	5	26.00	13.41	1.361	0.702
9 — 12	4	40.00	16.33	1.338	0.546
13 — 16	19	46.32	18.32	1.034	0.409
17 — 20	56	52.14	12.17	0.984	0.230
21 — 25	81	50.99	12.10	0.979	0.232
26 — 30	46	53.48	11.78	1.049	0.231
31 — 35	42	57.14	12.55	1.101	0.242
36 — 40	47	55.96	10.56	1.068	0.201
41 — 45	18	55.56	13.81	1.025	0.255
46 — 50	16	54.38	9.64	1.024	0.182
51 — 55	20	52.00	12.81	0.979	0.241
56 — 60	14	56.43	7.45	1.063	0.140
61 —	14	55.71	10.89	1.049	0.205
Total	389	—	—	—	—

Table 17. Weight of the pancreas and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	13	19.62	9.46	1.635	0.788
5 — 8	9	30.00	5.00	1.571	0.262
9 — 12	8	46.25	11.88	1.547	0.398
13 — 16	31	51.61	14.63	1.152	0.327
17 — 20	80	53.00	18.03	1.000	0.340
21 — 25	118	54.66	15.83	1.049	0.304
26 — 30	76	57.76	21.33	1.132	0.418
31 — 35	58	67.59	36.29	1.302	0.699
36 — 40	58	55.34	31.70	1.056	0.605
41 — 45	31	62.90	38.74	1.161	0.715
46 — 50	22	54.09	21.08	1.019	0.396
51 — 55	25	55.20	18.95	1.040	0.357
56 — 60	21	54.17	36.12	1.120	0.266
61 —	24	54.17	14.12	1.020	0.266
Total	574	—	—	—	—

Table 18. Weight of the spleen and the relative weight to the total body as a function of age (Female)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	8	18.13	8.43	1.450	0.674
5 — 8	7	32.86	7.56	1.668	0.384
9 — 12	8	33.33	15.06	1.145	0.517
13 — 16	38	51.58	13.26	1.131	0.291
17 — 20	131	56.87	12.53	0.967	0.213
21 — 25	139	56.97	12.75	0.929	0.208
26 — 30	139	56.04	12.49	0.908	0.202
31 — 35	98	56.22	12.48	0.929	0.206
36 — 40	125	57.67	12.10	0.927	0.194
41 — 45	97	56.13	12.57	0.910	0.204
46 — 50	61	53.93	12.42	0.951	0.219
51 — 55	37	53.24	13.34	0.939	0.235
56 — 60	44	57.93	13.32	1.022	0.235
61 —	36	57.50	12.51	1.014	0.221
Total	966	—	—	—	—

Table 19. Weight of the spleen and the relative weight to the total body as a function of age (Male)

Age (years)	Number of Sample	Mass of Organ		Mass of Organ/Total Body	
		Weight (g)	SD	Rel-Weight(g/kg)	SD
0 — 4	16	25.00	10.95	2.000	0.876
5 — 8	11	34.45	11.28	1.800	0.573
9 — 12	11	43.64	20.14	1.500	0.692
13 — 16	46	69.78	42.97	1.530	0.942
17 — 20	166	66.87	43.95	1.137	0.748
21 — 25	211	73.74	46.59	1.203	0.760
26 — 30	183	68.69	7.00	1.113	0.113
31 — 35	137	65.11	26.76	1.076	0.442
36 — 40	178	63.48	29.25	1.021	0.470
41 — 45	131	66.91	38.15	1.084	0.618
46 — 50	88	61.02	17.09	1.076	0.301
51 — 55	57	62.63	36.34	1.105	0.676
56 — 60	63	64.13	6.64	1.131	0.117
61 —	46	53.70	12.54	9.470	0.221
Total	1,344	—	—	—	—

Table 20. Size of the brain as a function of age (Female)

Age (years)	Number of Sample	Anteroposterior Diameter		Transverse Diameter		Vertical Diameter	
		Size(cm)	SD	Size(cm)	SD	Size(cm)	SD
0 — 4	10	14.40	1.96	13.00	3.02	6.95	0.72
5 — 8	7	15.86	0.90	13.86	1.57	7.42	0.73
9 — 12	5	15.00	1.41	13.00	1.87	7.00	1.58
13 — 16	28	17.13	1.19	14.95	2.06	7.91	0.63
17 — 20	68	17.67	1.57	15.60	1.89	8.22	0.68
21 — 25	101	17.55	1.26	15.48	1.84	8.22	0.75
26 — 30	58	17.60	1.29	15.33	1.82	8.11	0.66
31 — 35	50	18.06	1.36	14.86	1.64	8.04	1.33
36 — 40	53	17.70	1.44	15.83	1.74	8.37	0.49
41 — 45	24	17.98	1.31	14.96	2.33	8.41	1.11
46 — 50	21	17.93	1.69	15.31	1.83	8.39	0.49
51 — 55	23	17.40	1.19	15.63	1.92	8.22	0.58
56 — 60	15	18.13	1.25	14.97	1.82	8.25	0.56
61 —	21	17.52	1.36	15.23	1.79	7.97	0.71
Total	484	—	—	—	—	—	—

Table 21. Size of the brain as a function of age (Male)

Age (years)	Number of Sample	Anteroposterior Diameter		Transverse Diameter		Vertical Diameter	
		Size(cm)	SD	Size(cm)	SD	Size(cm)	SD
0 — 4	12	14.58	1.78	11.75	1.85	6.83	0.39
5 — 8	5	15.80	1.48	14.60	1.67	7.60	0.42
9 — 12	7	15.71	0.76	15.14	2.67	8.86	4.09
13 — 16	43	17.30	1.24	15.40	2.01	8.25	0.75
17 — 20	146	17.55	3.47	15.75	2.11	8.51	0.77
21 — 25	175	17.61	1.44	15.39	2.01	8.40	1.01
26 — 30	147	17.79	1.65	15.66	1.83	8.66	0.69
31 — 35	117	17.49	1.40	15.70	1.89	8.60	0.76
36 — 40	156	17.62	1.42	15.57	1.83	8.48	0.96
41 — 45	117	17.68	1.47	15.53	1.88	8.65	1.08
46 — 50	74	17.75	2.19	15.57	1.99	8.60	0.83
51 — 55	43	17.44	1.58	15.84	1.94	8.56	0.85
56 — 60	47	17.78	1.71	15.61	1.82	8.73	1.39
61 —	41	17.67	1.73	15.77	1.86	8.59	0.71
Total	1,129	—	—	—	—	—	—

that of the Japanese whereas it is very similar to that in the Caucasian. The size of the brain as a function of postnatal age is shown in Table 20 and 21.

Finally, we tried to compare the organ mass of the Korean with those of the Japanese and the Caucasian. As these results, the weights of the heart and lung in the Korean are found to be very similar to those in the Japanese. In the kidney and liver, a little differences were found but in the pancreas and spleen, much difference were found between the two races.

The reason of differences might be caused by various factors, for example, differences of the weight itself or of the sampling and measuring methods. Moreover, one of the main reason is believed that the number of sample is very limited. Though the result from such limited sample might not be significant statistically, it can be used as a basic data for the more precise estimation of radiation exposure in the future than in the past.

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<論 文> 標準韓國人의 最大許容被曝線量 設定에 관한 硏究

2. 臟器質量 및 腦의 크기

韓國에너지硏究所·放射線生物學硏究室

金英眞, 李康奭, 千基貞, 金鍾鳳, 鄭國鉉, 金三郎

韓國人에 대한 放射線影響을 豫測하고 그 防護對策을 講究하기 위한 基礎資料蒐集의 하나로서 國立科學搜査硏究所에서 韓國人 成人 1,921名의 屍體를 대상으로 各種 臟器의 質量을 測定調査한 資料를 蒐集 分析한 바 다음과 같은 結果를 얻었다.

1. 標準韓國人 腎臟의 質量은 男子에 있어서는 251.6g, 女子에 있어서는 227.7g이었다.
2. 標準韓國人 肺臟의 質量은 男子 1,204.4g, 女子 957.7g이었다.
3. 標準韓國人 心臟의 質量은 男子 348.8g, 女子 301.6g이었다.
4. 標準韓國人 肝臟의 質量은 男子 1,863.9g, 女子 1,610.9g이었다.
5. 標準韓國人 膵臟의 質量은 男子 56.4g, 女子 54.0g이었다.
6. 標準韓國人 脾臟의 質量은 男子 67.3g, 女子 58.2g이었다.
7. 標準韓國人의 頭蓋骨은 男子에 있어서는 前後頭長이 17.6cm, 左右頭長은 15.5cm, 上下頭長은 8.6cm이었으며 女子에 있어서는 前後頭長이 17.7cm, 左右頭長이 15.4cm 그리고 上下頭長은 8.2cm이었다.