Blood Pressure Level of Inhabitants in Medan, Indonesia

Tsuguo YANAGIHASHI*, Tsutomu TOMARI*, Komei TOMINAGA*
and Ichiro WAKISAKA*

I Introduction

Although the epidemiological study on hypertension should be started by the investigation of blood pressure levels of population groups, it was started by the study on cerebrovascular disease in Japan, because the presence of hypertension is considered to play a relatively important role, as an underlying disease, in the occurrence of cerebrovascular disease. On the other hand, the epidemiological study was started by the study on heart disease in Europe and the United States of America.

At all events, it has been proven by the studies carried out later that hypertension is closely related to cerebrovascular disease in Japan.

The blood pressure level of Japanese varies with population groups within the country and is not uniform, but the authors have been interested in comparison of blood pressure levels between Japan and foreign countries. When the authors were engaged in the Asahan Health Improvement Project (Proyek Pengembangan Kesehatan Asahan) conducted on North Sumatra in Indonesia, they had an opportunity to determine blood pressure of inhabitants in Medan City in cooperation with medical students of the North Sumatra University. This investigation was done together with a comprehensive health improvement action program by the Project.

II Methods of Investigation

Medan City is the capital of North Sumatra Province which lies almost in the north-western part of Sumatra Island. It is one of the biggest islands in the world, and Medan City has a population of about 1,200,000. It is the third biggest city in Indonesia. It is situated in lat. 3°N., and long. 98°E., faces the Malacca Strait and is about 265 km² in area.

It belongs to the equatorial climate zone (Delvert, 1967) and a year is roughly divided into the dry season from April to October and the rainy season from November to March. Its annual rainfall is about 2,000 mm and the temperature is 30–33°C at the highest and 21–23°C at the lowest (Kantor Sensus dan Statistik, 1978).

The subjects of the investigation were chosen at random from the inhabitants in Medan City. 3,935 healthy inhabitants at 15 or more years of age were covered in the study, comprising 2,221 males and 1,714 females. They were quite various in ethnic groups. Many of them were classified in Batak, Java, Malay and Chinese and others in Minangkabau, Padang, Aceh, Nias, etc. (18 in total). Table 1 shows the composition of these subjects arranged by sex, age, ethnic group and religion. A 81-year-old woman was included in the females from 70–79 years of age in this table. A significant difference was

* 鹿児島大学医学部公衆衛生学教室

* *Department of Public Health, Faculty of Medicine, Kagoshima University, Kagoshima 890, Japan*

Table 1 Composition of Study Subjects Arranged by Age, Religion, Sex and Ethnic Groups

Sex	Religion	Age (Yrs)	Ethnic Groups						Total
			Batak	Batak Karo	Chinese	Javanese	Malay	Others	
Male	Islam	15–19	14	5	0	70	18	40	147
		20–29	66	13	1	176	52	117	425
		30–39	48	21	1	90	37	49	246
		40–49	29	27	0	58	24	30	168
		50–59	14	14	0	26	12	13	79
		60–69	3	0	0	5	2	11	21
		70–	2	2	0	0	1	1	6
	Christian	15–19	90	10	5	2	0	0	107
		20–29	241	42	15	5	0	7	310
		30–39	149	41	10	1	0	3	204
		40–49	110	54	3	0	0	5	172
		50–59	63	33	3	0	0	0	99
		60–69	14	24	1	0	0	0	39
		70–	2	10	0	0	0	0	12
	Buddhist	15–19	0	0	19	1	0	0	20
		20–29	0	0	76	0	0	0	76
		30–39	0	0	32	1	0	1	34
		40–49	0	0	18	0	0	2	20
		50–59	0	0	15	0	0	0	15
		60–69	0	0	7	0	0	0	7
		70–	0	0	4	0	0	0	4
	Others	15–19	0	0	2	0	0	0	2
		20–29	0	0	2	0	0	1	3
		30–39	0	0	3	0	0	0	3
		40–49	0	0	0	1	0	1	2
		50–59	0	0	0	0	0	0	0
		60–69	0	0	0	0	0	0	0
		70–	0	0	0	0	0	0	0
	Subtotal		845	296	217	436	146	281	2221
Female	Islam	15–19	22	4	0	123	22	35	206
		20–29	70	14	0	150	46	66	346
		30–39	34	13	0	31	12	18	108
		40–49	9	10	0	25	7	10	61
		50–59	13	6	0	12	7	10	48
		60–69	1	3	0	7	3	3	17
		70–	2	0	0	3	1	3	9
	Christian	15–19	116	24	3	3	0	6	152
		20–29	210	37	14	10	0	6	277
		30–39	129	44	6	2	0	0	182
		40–49	45	40	3	0	0	0	88
		50–59	42	22	4	1	0	0	69
		60–69	14	11	2	0	0	1	28
		70–	5	3	0	0	0	0	8
	Buddhist	15–19	0	0	27	0	0	0	27
		20–29	0	0	44	0	0	0	44
		30–39	0	0	15	0	0	0	15
		40–49	0	0	11	0	0	0	11
		50–59	0	0	6	0	0	0	6
		60–69	0	0	2	0	0	0	2
		70–	0	0	2	0	0	0	2
	Others	15–19	0	0	1	1	0	0	2
		20–29	0	0	2	0	0	1	3
		30–39	0	0	0	2	0	0	2
		40–49	0	0	0	0	0	0	0
		50–59	0	0	0	1	0	0	1
		60–69	0	0	0	0	0	0	0
		70–	0	0	0	1	0	0	1
	Subtotal		712	231	142	372	98	159	1714
Grandtotal		1557	527	359	808	244	440	3935	

noted in age between males and females; namely the percentage of young subjects was higher in females than in males. A difference was also noted in the distribution of ethnic groups between males and females. Religion differed to a large extent with ethnic groups, and Buddhism was common in Chinese, Islam in Javanese and Malaysian and Christianity in Batak.

Blood pressure determination was carried out by the medical students of the North Sumatra Univ. Prior to the survey, the training for blood pressure measurements was organized so as to reduce as far as possible intra-and-inter observer's error.

Blood pressures were taken from the right upper arm in sitting position using a Tycos sphygmomanometer made in Japan. Systolic and diastolic (point of disappearance of vascular sound) blood pressures were determined by the auscultation method at any time.

This investigation was carried out from September, 1979 to January, 1980.

III Results

1. Frequency distribution curves of blood pressures arranged by sex and age groups (Fig. 1)

In males, the frequency distribution curves of systolic blood pressure are almost symmetrical and unimodal in younger subjects, though the blood pressure value at a peak varies with age. However, symmetry is lost gradually and the slope on the side of higher blood pressure becomes more gentle and longer with age; namely the rate of subjects showing the most frequent value decrease. Moreover, the blood pressure value at a peak becomes higher with age. The peak at 60–69 years of age is slightly flat.

In females the frequency distribution curves of systolic blood pressure are almost the same as those in males, though the peak at 40–49 years of age is flat. However, the slopes on the side of hypertension are not so gentle as in males.

In males the frequency distribution curves of diastolic blood pressure are also unimodal, but the range of distribution is narrow and the peak shifts toward hypertension with age. The peak is also not sharp, but slightly flat at 60–69 years of age.

In females frequency distribution curves of diastolic blood pressure are almost the same as those in males, but the range of distribution is largest at 50–59 years of age. The range of distribution of diastolic blood pressure is much narrower than that of systolic blood pressure in both males and females.

2. Blood pressures arranged by sex and age groups

Table 2 shows mean values of systolic and diastolic blood pressures by sex and age groups and prevalence rates of hypertension, borderline hypertension, normotension and hypotension. The hypertension, borderline hypertension and normotension were defined according to the criteria of WHO, and the normotensives whose systolic blood pressure was 100 mm-Hg and below was defined as hypotensives.

In males mean systolic blood pressure increases gradually with age and difference between young and old subjects is about 28 mm-Hg. There is not so much difference in the coefficients of variance. Mean diastolic blood pressure also increases with age.

In females mean systolic blood pressure increase with age as in males. However, age-dependent increase is not marked as compared with that in males and the mean systolic

Systolic Blood Pressure

Diastolic Blood Pressure

Fig. 1 Distribution Curves of Blood Pressure by Age Groups

blood pressure at 70–79 years of age is similar to that at 50–59 years in males. Mean diastolic blood pressure also increases with age just as in males.

The mean systolic and diastolic blood pressures of females are much lower than those of males in the same age group. Significant difference is found at 5% level in these blood pressures, except for the mean diastolic blood pressure at 15–19, 50–59 and 70–79 years of age.

In males, the percentage prevalence of hypertension increases with age. It shows almost the same tendency in females, and significant difference is found among age groups ($p < 0.01$). Significant difference was also found between males and females ($p < 0.01$).

The prevalence of borderline hypertension is the same as that of hypertension, but the values of prevalence are higher in males. Significant difference in the prevalence of borderline hypertension was found among age groups ($p < 0.01$). Significant difference was also found between males and females

($p < 0.01$).

The definition of hypotension differs with clinicians, but in this paper those with systolic blood pressures less than 100 mm-Hg are referred to as hypotensives, regardless of sex and age. In this investigation, the prevalence of hypotension is high in young subjects of both sexes. It decreases with age and no hypotensions are seen in males at 50 years or higher and in females at 40 years or higher. There is no difference in the prevalence of hypotension among males and females.

3. Blood pressures arranged by religious groups

The subjects of this investigation were classified according to religions in the district. There were 4 groups: Moslems, Christians both Protestants and Catholics, Buddhists and Others. Their blood pressures were observed for differences in their respective religions (Table 3).

In males, both of mean systolic and diastolic blood pressures are high in Christians and the prevalence of hypertension is high in Buddhists. In females, both of mean systolic

Table 2 Mean, Standard Deviation and Coefficient of Variance of Systolic and Diastolic Blood Pressure and Prevalence of Hypertension, Borderline Hypertension, Normotension and Hypotension Arranged by Sex and Age Groups

Sex	Age Group	Number of Cases	mm-Hg Blood pressure				Hypertension		Borderline Hypertension		Normotension		Hypotension	
			Systolic		Diastolic		Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%
			M $\pm$ SD	CV%	M $\pm$ SD	CV%								
Male	15–19	276	114.5 $\pm$ 10.8	9.4	76.3 $\pm$ 7.4	9.6	2	0.72	5	1.81	241	87.32	28	10.14
	20–29	814	119.7 $\pm$ 10.8	9.0	78.8 $\pm$ 6.9	8.7	10	1.23	71	8.72	702	86.24	31	3.81
	30–39	487	124.5 $\pm$ 9.2	7.3	81.5 $\pm$ 6.4	7.8	13	2.67	59	12.11	410	84.19	5	1.03
	40–49	362	130.1 $\pm$ 10.2	7.8	84.2 $\pm$ 6.5	7.7	20	5.52	81	22.38	257	70.99	4	1.10
	50–59	193	132.9 $\pm$ 10.7	8.0	85.9 $\pm$ 6.7	7.7	14	7.25	76	39.38	103	53.37	0	–
	60–69	67	139.1 $\pm$ 13.1	9.4	88.2 $\pm$ 6.8	7.7	11	16.42	31	46.27	25	37.31	0	–
	70–79	22	142.4 $\pm$ 14.2	9.9	88.1 $\pm$ 8.9	10.1	6	27.27	11	50.00	5	22.73	0	–
Female	15–19	387	114.0 $\pm$ 10.1	8.8	75.7 $\pm$ 7.0	9.2	3	0.78	9	2.33	346	89.41	29	7.49
	20–29	670	116.7 $\pm$ 9.4	8.0	77.5 $\pm$ 6.4	8.2	5	0.75	31	4.63	609	90.90	25	3.73
	30–39	306	121.7 $\pm$ 10.1	8.2	79.8 $\pm$ 5.8	7.2	1	0.33	25	8.17	276	90.20	4	1.31
	40–49	160	126.5 $\pm$ 9.7	7.6	82.5 $\pm$ 6.3	7.6	6	3.75	25	15.63	129	80.63	0	–
	50–59	124	129.9 $\pm$ 11.0	8.4	84.4 $\pm$ 8.0	9.4	6	4.84	33	26.61	85	68.55	0	–
	60–69	47	133.0 $\pm$ 8.0	6.0	85.5 $\pm$ 6.3	7.3	2	4.26	19	40.43	26	55.32	0	–
	70–79	20	134.8 $\pm$ 9.7	7.1	84.5 $\pm$ 6.4	7.5	1	5.00	8	40.00	11	55.00	0	–

and diastolic blood pressures are high in Christians. When blood pressures are compared between males and females in each religious group, they are high in males in Islamites, Christians and Buddhists. In Others, the prevalence of hypertension is high in females but low in males, the prevalence of hypotension is high in both sexes while no sex-related difference of blood pressure is found, which are most likely a results of the smallness of the members examined in this group.

4. Blood pressures according to ethnic groups

The subjects were classified according to ethnic groups. There were 6 groups: Batak, Batak-Karo, Javanese, Malay, Chinese and others. They were observed for differences in blood pressure (Table 4). In males, both of mean systolic and diastolic blood pressures are high in Batak-Karo, but low in Javanese. The prevalence rates of hypertension and borderline hypertension are high in Chinese and Batak-Karo, respectively. The prevalence of hypotension is high in Javanese and Chinese.

In females, both of mean systolic and diastolic blood pressures are high in Batak-Karo, but low in Others. The prevalence rates

Table 3 Mean and Standard Deviation of Systolic and Diastolic Blood Pressures and Prevalence of Hypertension, Borderline Hypertension, Normotension and Hypotension Arranged by Sex and Religion

Sex	Religion	Number of Cases	mm-Hg Blood Pressure		Hypertension		Borderline Hypertension		Normotension		Hypotension	
			Systolic M $\pm$ SD	Diastolic M $\pm$ SD	Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%
Male	Islam	1092	122.9 $\pm$ 12.0	80.7 $\pm$ 7.4	35	3.21	169	15.48	849	77.75	39	3.57
	Christian	943	125.3 $\pm$ 10.8	81.4 $\pm$ 6.6	24	2.55	132	14.00	776	82.29	11	1.17
	Buddhist	176	122.0 $\pm$ 17.9	80.3 $\pm$ 11.3	17	9.66	32	18.18	112	63.64	15	8.52
	Others	10	107.0 $\pm$ 16.8	73.4 $\pm$ 9.8	0	—	1	10.00	6	60.00	3	30.00
Female	Islam	795	117.7 $\pm$ 11.3	78.2 $\pm$ 7.1	9	1.13	68	8.55	685	86.16	33	4.15
	Christian	803	122.1 $\pm$ 10.1	79.8 $\pm$ 6.5	11	1.37	68	8.47	713	88.79	11	1.37
	Buddhist	107	113.3 $\pm$ 13.2	76.2 $\pm$ 9.7	3	2.80	12	11.21	80	74.77	12	11.21
	Others	9	115.5 $\pm$ 21.6	75.5 $\pm$ 13.4	1	11.11	2	22.22	4	44.44	2	22.22

Table 4 Mean and Standard Deviation of Systolic and Diastolic Blood Pressures and Prevalence of Hypertension, Borderline Hypertension, Normotension and Hypotension Arranged by Sex and Ethnic Groups

Sex	Ethnic Group	Number of Cases	mm-Hg Blood Pressure		Hypertension		Borderline Hypertension		Normotension		Hypotension	
			Systolic M $\pm$ SD	Diastolic M $\pm$ SD	Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%
Male	Batak	845	124.0 $\pm$ 10.4	81.0 $\pm$ 6.8	24	2.84	111	13.14	697	82.49	13	1.54
	Batak-Karo	296	130.9 $\pm$ 9.2	83.5 $\pm$ 5.3	11	3.72	62	20.95	223	75.34	0	—
	Chinese	217	121.8 $\pm$ 17.8	80.4 $\pm$ 11.1	20	9.22	37	17.05	142	65.44	18	8.29
	Javanese	436	119.7 $\pm$ 14.1	79.0 $\pm$ 8.6	12	2.75	50	11.47	337	77.29	37	8.49
	Malay	146	124.3 $\pm$ 8.8	81.7 $\pm$ 5.7	4	2.74	23	15.75	119	81.51	0	—
	Others	281	123.5 $\pm$ 9.2	81.5 $\pm$ 6.1	5	1.78	51	18.15	225	80.07	0	—
Female	Batak	712	120.9 $\pm$ 9.6	79.5 $\pm$ 6.3	9	1.26	56	7.87	635	89.19	12	1.69
	Batak-Karo	231	125.4 $\pm$ 9.0	80.9 $\pm$ 4.8	0	—	26	11.26	205	88.74	0	—
	Chinese	142	114.7 $\pm$ 15.4	77.0 $\pm$ 10.6	6	4.23	15	10.56	107	75.35	14	9.86
	Javanese	372	116.7 $\pm$ 12.4	77.2 $\pm$ 8.4	7	1.88	31	8.33	303	81.45	31	8.33
	Malay	98	119.2 $\pm$ 9.3	79.1 $\pm$ 5.0	0	—	9	9.18	88	89.80	1	1.02
	Others	159	115.8 $\pm$ 10.6	77.7 $\pm$ 6.5	2	1.26	13	8.18	144	90.57	0	—

of hypertension and hypotension are high in Chinese.

When blood pressures are compared between males and females, mean blood pressures are higher in males than in females in every ethnic group. There is no sex-related difference in the prevalence rates of hypertension, borderline hypertension and hypotension. However, there is difference in the prevalence of normotension. It is lower in males than in females in every ethnic group.

5. Blood pressures according to body-build

Each subject was asked to report his or her height and body weight to examine the relationship between body-build and blood pressure.

The so-called standard body weights were determined by the Broca method, and the subjects were classified on the basis of standard and actual body weight ratios into "emaciation group (-10% or less)", "standard body weight group (-9% – 9%)", "excess body

weight group (10% – 19%)" and "obesity group (20% or higher)".

When the percentages of "excess body weight group" and "obesity group" are compared between males and females, they are significantly higher in females than in males ($p<0.01$). In both males and females, the percentages of the excess body weight group and obesity group increase with age until 40–49 years of age, but decrease from 50–59 and from 60–69 years of age. However, mean blood pressure increases with age in every body-build group, and moreover, it shows a tendency toward increase with body weight (emaciation < standard body weight < excess body weight < obesity). This tendency shows that blood pressure is gradually high in obese persons when blood pressure levels are discussed in terms of body-build levels. In addition, the association of overweight and elevated blood pressure seems to be even stronger in females than in males.

Table 5 Mean and Standard Deviation of Systolic and Diastolic Blood Pressures by Sex, Age Groups, Blood Pressure Types and Broca's Index Types

Sex	Group		Broca's Index													
			Less than -10%				-9% - +9%				10% - 19%				20% and over	
	(Yrs)	Total	No.	Blood Pressure mm-Hg		No.	Blood Pressure mm-Hg		No.	Blood Pressure mm-Hg		No.	Blood Pressure mm-Hg			
				Systolic M±SD	Diastolic M±SD		Systolic M±SD	Diastolic M±SD		Systolic M±SD	Diastolic M±SD		Systolic M±SD	Diastolic M±SD		
Male	15-19	276	160	114.0±11.4	76.2± 7.6	109	115.2± 9.9	76.4±7.3	6	115.0± 9.6	74.6± 4.7	1	120	84		
	20-29	814	377	117.8±10.6	78.0± 7.1	407	120.8± 9.9	79.3±6.4	19	127.2±13.9	84.6± 8.9	11	132.7±17.1	80.5±7.4		
	30-39	487	131	122.7± 7.7	80.3± 5.6	293	125.2± 9.2	81.8±6.3	37	126.1± 9.0	82.9± 7.0	26	125.0±13.2	83.2±9.2		
	40-49	362	67	127.4±12.4	83.1± 8.1	216	129.8± 9.0	84.0±5.9	54	132.8±10.0	85.7± 5.9	25	134.1±11.7	85.2±6.4		
	50-59	193	42	130.6± 7.6	84.5± 5.3	122	132.2±10.1	85.6±6.7	20	14.8±16.5	89.0± 8.8	9	136.6± 4.5	89.7±4.8		
	60-69	67	23	140.9±17.0	89.2± 7.0	37	138.4±11.0	87.2±6.5	6	136.0± 7.6	89.6± 7.1	1	140	90		
	70-	22	10	140.4±19.0	88.0±11.0	10	145.2± 8.0	88.0±6.6	2	139.0± 5.0	90.0± 6.0	0	-	-		
Female	15-19	387	134	111.3± 9.5	74.9± 6.6	229	115.0±10.1	76.2±6.9	20	118.4± 9.8	77.2± 9.2	4	121.5± 7.1	79.5±0.9		
	20-29	670	205	114.9± 9.1	77.0± 5.7	408	117.5± 9.5	77.7±6.7	40	117.5± 9.4	77.7± 6.7	17	117.6± 9.7	78.8±7.3		
	30-39	306	43	118.0±10.2	78.9± 6.4	188	121.2±10.2	79.5±5.5	48	124.8± 9.2	81.5± 5.7	27	124.8± 8.4	80.9±6.2		
	40-49	160	7	115.4±11.3	76.2± 5.5	91	125.6± 8.0	81.6±5.1	30	130.0± 9.2	85.7± 7.0	32	128.3±11.9	83.3±7.2		
	50-59	124	16	127.2±11.1	82.1± 5.0	71	129.0± 7.9	84.1±6.3	19	134.9±19.7	88.0± 2.6	18	13.3± 5.5	83.6±8.8		
	60-69	47	5	132.0± 5.0	84.4± 4.6	31	131.8± 8.8	84.5±6.2	7	135.7± 3.6	90.0± 6.8	4	139.0± 7.3	86.5±4.1		
	70-	20	4	130.0± 0.0	80.0± 0.0	6	133.3± 5.6	87.6±2.9	6	131.6±10.3	82.3± 6.9	4	146.5± 9.3	87.5±8.3		
Male	Hypertensives	76	18	151.5±17.4	98.5± 8.0	34	151.4±13.1	99.7±7.0	16	153.5±14.3	100.6± 6.9	8	151.7±14.3	98.0±3.3		
	Borderline hypertensives	334	83	134.1± 7.4	89.3± 3.0	193	134.9± 8.3	88.8±3.6	34	135.5± 7.1	89.0± 2.8	24	136.3± 7.2	87.8±5.2		
	Normotensives	1743	663	119.8± 7.4	78.7± 4.7	947	122.7± 7.9	69.7±4.7	94	125.4± 8.5	81.0± 4.1	39	125.4± 5.3	80.7±3.2		
	Hypotensives	68	46	89.6± 5.5	61.8± 5.8	20	90.5± 5.1	60.5±6.8	0	-	-	2	89.0± 9.0	61.0±1.0		
Female	Hypertensives	24	2	132.0±22.0	100.0± 0.0	12	141.8±20.4	99.0±1.5	7	151.1±24.3	106.5±10.4	3	152.0± 5.9	100.0±0.0		
	Borderline hypertensives	150	15	134.9± 7.3	88.6± 3.7	78	132.6± 8.6	89.4±2.8	34	133.5± 8.8	88.5± 4.0	23	137.2± 6.7	88.3±4.0		
	Normotensives	1482	381	115.0± 8.3	76.7± 5.0	894	119.5± 7.6	78.3±4.8	127	121.9± 8.7	79.2± 5.3	80	123.0± 9.2	79.7±6.4		
	Hypotensives	58	16	91.5± 3.6	64.1± 7.4	40	91.1± 5.4	61.9±6.5	2	92.0± 2.0	56.0± 6.0	0	-	-		

IV Discussion

In the comparison of blood pressure levels among different districts of different population groups, attention should always be given to the methods of blood pressure determination. The authors determined the blood pressure of inhabitants in Medan City on the basis of the manual of the National Nutrition Survey (1979), except for a sphygmomanometer.

In this survey, blood pressure was determined at any time, regardless of season or time. However, the results obtained are enough to reflect part of the blood pressure level of local inhabitants in Medan, Indonesia.

In the frequency distribution curves of blood pressures by sex and age groups, the range of distribution of systolic blood pressure is wider than that of diastolic blood pressure in both males and females, showing compatibility with the generally known fact. However, the range of distribution of systolic blood pressure is much narrower in Medan City than in Japan, when compared with the results of the National Nutritional Survey carried out in November, 1979. Both of systolic and diastolic blood pressures tend to increase with age in males and females, showing consistency with the results of similar survey (Kartari *et al.* 1979) previously performed on the natives of this country, indicating a natural physiological change of the blood vessels with advancing age. However, age-dependent increase in blood pressure is not so marked in females as compared with males. The probable explanation for this phenomenon is that the association of overweight and elevated blood pressure may be stronger in females than in males.

In general, when compared with the Japanese average blood pressure, the systolic

readings of Indonesians are lower than those of Japanese in all age groups. This may be due to the climatic difference between the two countries. On the contrary, the diastolic readings of Indonesians, naturally expected to be low, are higher in all age groups than those of Japanese. The reason for this high diastolic readings is unknown, but similar result has been obtained by Kartari *et al.* in the survey carried out in Jakarta, Indonesia, in which an increase in diastolic pressure is supposed to be attributable to rapid urbanization. The prevalence of hypertension increases with age in both males and females and so does the prevalence of borderline hypertension. These prevalence rates, especially those of hypertension are significantly higher in males than in females. Such differences can not be explained from the body-build factors, because the percentages of excess body weight and obesity are higher in females and increase with age until 40 years' but decrease thereafter with advancing age.

Medan, the largest city in Sumatra Island, is an important point of traffic and the inhabitants are quite varied in ethnic groups, which are capable of classifying into as many as 18 ethnic groups, including Chinese, Indians and Singhalese all of whom are inhabitants of foreign origin. Religions also differ with ethnic groups and are closely related to daily living. The subjects of this investigation were classified according to 4 representative religions including Others and to 6 major ethnic groups for the possible differences in the pattern of blood pressure values. The results indicate that there are some differences in blood pressure level or prevalence of hypertension among religious groups and/or ethnic groups. This is different from the result of Kartari *et al.*, in which no significant differ-

ences of hypertension rates were found between the ethnic groups. However, it remains to be elucidated whether such differences are attributable to religions or ethnic groups, because religions markedly differ with ethnic groups.

There are relatively large amounts of reports which indicate that obesity is related to blood pressure elevation (Chiang *et al.*, 1969; Tsukamoto *et al.*, 1970; Johnson, 1970; Heller *et al.*, 1978; Stamler *et al.*, 1978). Since it was not clear whether the so-called standard body weight table of Indonesian was available or not, the Broca method was used for convenience for observing presence of a relationship between body-build and blood pressure. There may arise a question whether the Broca method can directly be applicable to Indonesians or not. However, the subjects of this survey were classified according to the Broca method into "emaciation group", "standard body weight group", "excess body weight group" and "obesity group" and observed for relationship between body-build and blood pressure. As a result, it has been found that blood pressure is generally high in obese persons.

Indonesia is an island country which is several thousand kilometers from east to west with New Guinea Island at its eastern end. The eastern half of this island is the country of Papua New Guinea. According to the results of the survey previously carried out in this country (Whyte, 1958), the blood pressure of highland inhabitants is higher than that in Medan in young age group, but lower at 40–49 and 50–59 years of age. It becomes higher again at 60–69 and 70–79 years of age, but is maintained at almost the same level as that at 20–29 years of age. On the other hand, the blood pressure of male coastal

inhabitants of this country is 133 mm-Hg at 20–29 years of age, followed by gradual decrease with age to the lowest value of 125 mm-Hg at 50–59 years of age. In older females blood pressure is lower than in young females. The blood pressure distribution patterns of inhabitants living in the two different districts in Papua New Guinea are quite different from those obtained in this study in Medan, Indonesia. It remains to be elucidated what the reasons are for such difference.

V Summary

During the period from September, 1979 to January, 1980, a survey of blood pressure was carried out in Medan City, North Sumatra Province, Indonesia. 3,935 healthy inhabitants were covered in this survey, comprising 2,221 males and 1,714 females.

The results are described below:

1. When compared with the Japanese average blood pressure values, the systolic readings of the subjects of this investigation are lower than those of Japanese while the diastolic readings are higher.
2. Both of systolic and diastolic blood pressure increase with age in both males and females but the age-dependent increase is not so marked in females as compared with males.
3. The percentage prevalences of hypertension and borderline hypertension increase with age in both males and females. These prevalence rates are significantly higher in males than in females.
4. There are some differences in blood pressure level or prevalence of hypertension among religious groups and/or ethnic groups. For instance, blood pressure levels are high in Christians or Batak-Karo but low in Buddhists or Javanese.
5. The percentages of excess body weight

and obesity groups are higher in females than in males. The blood pressure level and prevalence of hypertension are generally high in obese persons for both sexes. In addition, the association of overweight and elevated blood pressure seems to be stronger in females than in males.

VI Acknowledgement

The authors are very grateful to the medical students of the North Sumatra University for their devoted assistance without whom this study would have been impossible.

References

- Boedhi Darmojo, R., Sugiri, Harmadji, Suharti, Ch., Suhardjo and Iman Parsudi (1977): A survey of hypertension on an island of Karimunjawa and Parang, Bulletin Penelitian Kesehatan (Health Studies in Indonesia), 5(2), 7-12.
- Chiang B.M., Perman L.V. and Epstein F.H. (1969): Overweight and hypertension. A review, *Circulation*, 39, 403-421.
- Delvert J. (1967): *Geographie de L'Asie du sud-est*, (collection QUE SAIS-JE? N° 1,242 in Japanese)
- Heller R.F., Rose H., Tunstall Pedoe H.P. and Christie G.S. (1978): Blood pressure measurement in the United Kingdom Heart Disease Prevention Project, *J. Epidemiol. Comm. Hlth.*, 32, 235-238.
- Johnson T.O. (1970): Prevalence of overweight and obesity among adult subject of urban African population sample, *Brit. J. Prev. Soc. Med.*, 24, 105-109.
- Kantor Sensus dan Statistik TK I Sumatera Utara (1978): *Buku Statistik Tahunan*, Medan. (Public Report).
- Kartari D.S., Buchari Lapau and Sulianti Saroso J. (1979): Blood pressure values and prevalence of hypertension in certain ethnic groups in Indonesia, 1976, Bulletin Penelitian Kesehatan (Health Studies in Indonesia), 7(1), 35-52.
- Ministry of Health and Welfare (1977): *Manual of the National Nutrition Survey 1977*, 22, Tokyo, (in Japanese).
- Nutrition Division, Public Health Bureau, Ministry of Health and Welfare (1980): *The Epitome of the National Nutrition Survey 1979*. The Ministry of Health and Welfare Japan, Tokyo, (in Japanese).
- Stamler R., Stamler J., Riedlinger, W.F., Algeria, G. and Roberts, R.H. (1978): Weight and blood pressure. Findings in hypertension screening in 1 million Americans, *J.A.M.A.*, 240, 1607-1610.
- Tsukamoto H., Obara M. and Yoshida T. (1970): *Seimeihoken Moshikomisha no Taikaku ni Tsuite; Tokuni Himan no Shakaiteki Haikei o Chushin ni* (Body-build of applicant for life insurance - especially around the social back-ground of obesity), *Hoken Igaku Zasshi*, 68, 88-94 (in Japanese).
- WHO (1959): Hypertension and coronary heart disease; Classification and criteria for epidemiological studies, WHO Technical Report No. 168, 10.
- Whyte H.M. (1958): Body fat and blood pressure of natives in New Guinea; Reflections on essential hypertension, *Aust. Ann. Med.*, 7, 36-46.

[和文抄録]

インドネシア国メダン市の住民の血圧水準

柳 橋 次 雄 泊
脇 阪 一 郎

惇 富 永 浩 盟

1979年9月から1980年1月までの期間に、インドネシア共和国北スマトラ州メダン市で病者を除く15歳から81歳までの男女の住民3,935名(男2,221名,女1,714名)の血圧測定を行った。

結果は次のようであった。

1) 日本人の血圧の平均値と比較すると、収縮期血圧は低く、拡張期血圧は高かった。

2) 収縮期血圧と拡張期血圧との両方が、男女とも加齢に従って高くなっているが、女の場合は男ほどに高くはなっていなかった。

3) 高血圧、境界域高血圧の出現の割合は男女ともに加齢とともに多くなっていた。この割合は

女よりも男に有意に多かった。

4) 信教の違いと、あるいはまた種族的な違いとで、血圧水準、あるいは高血圧者の割合に差異が認められた。例えば、血圧水準はキリスト教徒、あるいはバタ・カロ族では高いが、仏教徒あるいはジャワ族では低かった。

5) 過体重者や肥満者の割合は、男より女に多かった。血圧水準と高血圧(者)の割合は、概して両性ともに肥った者には高かった。加えて、オーバーウェイトと血圧上昇との関係は男よりも女に強いように思われた。

(受稿 1985.10.30)