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# The Third Japan-Nepal Health Scientific Expedition

—Comparative Epidemiological Studies on the Genesis  
of Hypertension: A Preliminary Report—

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## Preface

Hypertension will be a major health problem in every country.<sup>1,2,10</sup> For the present, it is true that the developing countries have immense health problems like communicable diseases and parasitic infestations. However, the prevalence of hypertension in Nepal has been increasing unmistakably along with rapid urbanization.

According to the previous studies the prevalence rate in urban community was 9.9% for both sexes, while in a rural community of Bhadrabas village the rate was only 6% by WHO criteria.<sup>8</sup> Our previous study also showed a markedly low rate of 0.7% in Kotyang village, Khabhre District, and 7.3% in Bhadrakali village, Kathmandu District.<sup>9</sup> Although these values are still lower than those of the developed countries, it should be noted that Nepal can not be exempted from hypertension, "silent killer", in future.

Many works have been suggested that an inter- and cross-disciplinary study on the genesis of hypertension is necessary since factors affecting the pathogenesis of hypertension are not only physical but also cultural. Therefore, an international study extending into different cultures and

societies with uniform protocol should be undertaken in order to clarify the question.

## List of Members

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Some other Japanese and Nepalese assistants  
joined us though their names were not presented  
here.

### Objects

During the summer in 1987, the first interna-  
tional joint research, titled "Tribhuvan University  
Kyushu University Hypertension Project (TUKU-  
HP)", was carried out by the "Japan-Nepal  
Health Scientific Expedition (JANESE'87)" group,  
which was composed of the dean and professor of  
the Institute of Medicine, Tribhuvan University,  
and Japanese specialists of hypertension, exercise  
physiology, nutrition, and cultural geography.  
The ultimate goal of this project was to clarify the  
factors which affect the pathogenesis of hyper-  
tension in terms of epidemiology. Comparing the  
health status, dietary practice, and physical activ-  
ities of the Nepalese people, whose blood pres-  
sures are low in general, with those of the  
Japanese, we wanted to know the important con-  
ditions which generate the hypertension.

The blood pressure, body fat mass, serum  
chemistries, nutritional intake of the inhabitants  
were measured at the two sites in Nepal, one of  
which was a hilly village, named Kotyang in  
Kabhre District, and the other a suburban village,  
Bhadrakali, in Kathmandu District. The preva-  
lence rates of the hypertensives in both sites (0.  
7% in Kotyang, 7.3% in Bhadrakali) were by far  
lower than those in Japan (25-30% in general) in  
spite of the fact that the levels of average salt  
intake were almost identical. Taking the other  
results into consideration, we assumed that the  
blood pressure might be influenced by physical  
activity, fat-free mass and nutrient intake, and  
that exceedingly low body mass index could serve  
to mute the effect of high sodium intake.

On the basis of these results which were accepted

with great interest at the two international  
meetings<sup>3,4</sup>, we successfully carried out the sec-  
ond TUKUHP research from February 14 till  
March 28 of this year with the cooperation and  
assistance of the staffs of the Institute of Medi-  
cine, Tribhuvan University, and confirmed the  
previous results.

The purpose of the third TUKUHP research  
was to find out the difference of body composi-  
tion, blood pressure, blood chemistries, nutrient  
intakes and physical activities between the  
Tibetan people living at Jawalakhel and Boud-  
hanath and those who were investigated in the  
first and the second TUKUHP study as these  
Tibetan people are still taking "salt tea" and their  
salt consumption is said to be more than 20g per  
day.

The identical methods with the previous TUKU-  
HP research were applied to the third one so that  
we can compare it with the previous data.

### Annexed Objects :

- 1) Diagnosis and treatment of the people con-  
cerned, including the children.
- 2) A contribution to the accumulation of the  
information on the amelioration of nutritional sta-  
tus in Nepal.
- 3) A contribution to the development of the sci-  
entific fields included in this project in Nepal.
- 4) The promotion of the scientific relationship  
between Japan and Nepal.

### Location and Period of Survey

Two field studies were carried out in 6 monas-  
teries in Boudhanath area (Boudhanath) and in  
Jawalakhel Refugee Camp (Jawalakhel). The for-  
mer is located in the east part of Kathmandu, and  
it is about 6 km from the center of the city. The  
latter is located in the southern part and is also  
about 6 km from the city. The period surveyed  
was from September 2nd to 7th in Boudhanath and  
from September 9th to 19th, 1990, in Jawalakhel,  
respectively.

### Temporary View on the Results

The same methods as in the first and the second study were applied to the present one. The subjects aged 20 and older participated in the survey.

#### 1. Medical Survey

##### 1) Subjects

Two hundred and twelve monks(20-80yrs) in

Boudhanath and 548 subjects (20-85yrs) in Jawalakhel participated in the medical survey. The age and the sex distributions by decade in two areas are shown in Table 1. More than 90% of all monks at 6 monasteries in Boudhanath and 67.4% of the inhabitants registered in inside and outside Camp of Jawalakhel were studied.

##### 2) Methods

Almost the same medical chart as the previous

Table 1. Number of Subjects Examined by Age, Sex and Area

Age Group (yrs)	20-29	30-39	40-49	50-59	60-69	70-	Total
Boudhanath*	121	28	12	18	25	8	212
(%)	(57.0)	(13.2)	(5.7)	(8.5)	(11.8)	(3.8)	(100)
Jawalakhel [Men]	65	56	30	55	29	7	242
(%)	(26.9)	(23.1)	(12.4)	(22.7)	(12.0)	(2.9)	(100)
Jawalakhel [Women]	88	65	66	49	24	14	306
(%)	(28.8)	(21.2)	(21.6)	(16.0)	(7.8)	(4.6)	(100)

The subjects aged 20 years and over participated in the survey.

\* Monks living in Boudhanath were subjected.

Table 2. Classification of Normotensive (NT), Borderline Hypertensive (BHT) and Hypertensive (HT) Subjects by Age, Sex and Area

Age Group (yrs)	20-29	30-39	40-49	50-59	60-69	70-	Total
Boudhanath							
NT	121(100)	26(92.9)	11(91.7)	13(72.2)	13(52.0)	4(50.0)	188(88.7%)
BHT	0	2( 7.1)	1( 8.3)	1( 5.6)	1( 4.0)	0	5( 2.3%)
HT	0	0	0	4(22.2)	11(44.0)	4(50.0)	19( 9.0%)
Jawalakhel [Men]							
NT	64(98.5)	48(85.7)	25(83.3)	29(52.8)	9(31.0)	2(28.6)	177(73.1%)
BHT	1( 1.5)	5( 8.9)	3(10.0)	8(14.5)	7(24.1)	3(42.8)	27(11.2%)
HT	0	3( 5.4)	2( 6.7)	18(32.7)	13(44.9)	2(28.6)	38(15.7%)
Jawalakhel [Women]							
NT	88(100)	62(95.4)	57(86.4)	36(73.5)	15(62.5)	3(21.4)	261(85.3%)
BHT	0	1( 1.5)	4( 6.1)	6(12.2)	7(29.2)	5(35.7)	23( 7.5%)
HT	0	2( 3.1)	5( 7.6)	7(14.3)	2( 8.3)	6(42.9)	22( 7.2%)

Number in parenthesis reveals percentage.

NT : SBP<140 and DBP<90 mmHg, BHT : SBP=140-159 and/or DBP=90-94 mmHg,

HT : SBP≥160 mmHg and/or DBP≥95 mmHg.

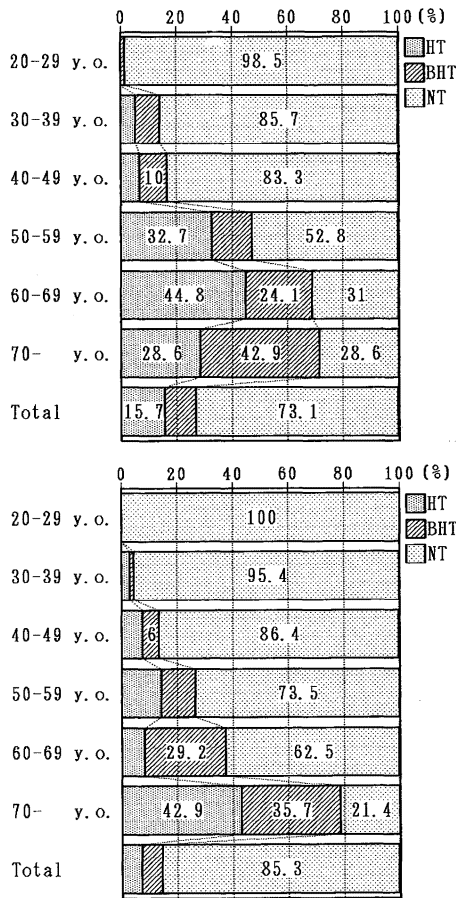


Fig 1. Classification of normotensive, borderline hypertensive and hypertensive subjects by age group and sex in Jawalakhel. NT: normotensive subjects, BHT: borderline hypertensive subjects, HT: hypertensive subjects

one was prepared in advance, and the individual medical check was carried out according to this chart.

(1) Family history, life history, present status and physical examination were checked by Nepalese doctors and nurses.

(2) Body height, body weight and skinfold thickness were measured by one examiner (T.O.).

(3) The subjects usually voided in the morning after arising. The next voided urine was collected as "the second morning voiding urine" into a paper cup and 8 items (pH, protein, sugar, occult blood,

urobilinogen, bilirubin, bacteria and keton body) were determined semiquantitatively using the strip (BMTEST 8-11, Yamanouchi Pharmaceutical Co., Ltd., Tokyo, Japan) by one examiner. Approximately 10ml of urine specimen was stored in a plastic tube to determine Na, K and creatinine concentration. Then, 24-hour Na and K excretions are to be estimated by means of the equations<sup>5)</sup>.

(4) Blood pressure (BP) and pulse rate (PR) were measured 3 times consecutively in the right arm in the sitting position using the semiauto-matic BP measuring device (OMRON HEM 401C, Tateishi Electronic Co., Kyoto, Japan) prior to the blood sampling. The average of 3 consecutive measurements for systolic (SBP) and diastolic BP (DBP) and PR were computed and were adopted for the analyses. According to WHO criteria, the subjects were classified into 3 groups; normotension ( $SBP < 140$  and  $DBP < 90$  mmHg), borderline hypertension ( $140 \leq SBP < 160$  and/or  $90 \leq DBP < 95$  mmHg) and hypertension ( $SBP \geq 160$  and/or  $DBP \geq 95$  mmHg).

(5) Approximately 10 ml of blood was drawn through the median vein of the subjects. The blood specimen was centrifuged and serum was frozen at  $-20^{\circ}\text{C}$  until the chemical determinations are performed in Japan. Complete blood counts (CBC; hemoglobin, hematocrit and red and white blood cell counts), differential counts and blood type were determined at Hematology Laboratory in Teaching Hospital.

(6) Electrocardiogram was taken by 3 channel recorder (Cardimax; FUKUDA DENSI Co., Ltd., Tokyo, Japan).

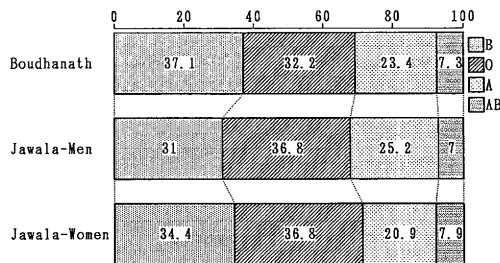
(7) Medicines were supplied individually according to the doctor's prescription.

### 3) Results (briefly)

The results of BP measurements in both areas are briefly shown in Table 2. The incidences of borderline hypertension (BHT) and hypertension (HT) were 2.3% and 9.0% in Boudhanath, and 11.2% and 15.7% in men and 7.5% and 7.2% in women in Jawalakhel, respectively. The incidence of HT in Jawalakhel clearly increased with

**Table 3.** Number and Percentage of Subjects for Hematological Parameters by Sex and Area

Area & Parameter	Reference Range	Low (%)	Normal (%)	High (%)
<b>Boudhanath</b>				
Hemoglobin(g/dl)	13.5-17.6	23(11.2)	182(88.8)	0
Hematocrit(%)	39.8-51.8	14( 6.8)	191(93.2)	0
RBC ( $\times 10^4/mm^3$ )	427-570	11( 5.4)	167(81.4)	27(13.2)
WBC (/mm <sup>3</sup> )	3500-9800	0	172(83.9)	33(16.1)
Neutrophil(%)	48-61	7( 3.4)	59(28.8)	139(67.8)
Lymphocyte(%)	25-45	0	194(94.6)	11( 5.4)
Eosinophile(%)	0-5	0	147(71.7)	58(28.3)
<b>Jawalakhel (Men)</b>				
Hemoglobin(g/dl)	13.5-17.6	21( 8.7)	215(88.8)	6( 2.5)
Hematocrit(%)	39.8-51.8	19( 7.9)	212(87.6)	11( 4.5)
RBC ( $\times 10^4/mm^3$ )	427-570	26(10.7)	200(82.6)	16( 6.6)
WBC (/mm <sup>3</sup> )	3500-9800	2( 0.8)	207(85.5)	33(13.6)
Neutrophil(%)	48-61	28(11.6)	117(48.3)	97(40.1)
Lymphocyte(%)	25-45	18( 7.4)	173(71.5)	51(21.1)
Eosinophile(%)	0-5	0	159(65.7)	83(34.3)
<b>Jawalakhel (Women)</b>				
Hemoglobin(g/dl)	11.3-15.2	11( 3.6)	278(92.1)	13( 4.3)
Hematocrit(%)	33.4-44.9	7( 2.3)	265(87.7)	30( 9.9)
RBC ( $\times 10^4/mm^3$ )	376-500	11( 3.6)	241(79.8)	50(16.6)
WBC (/mm <sup>3</sup> )	3500-9800	5( 1.7)	261(86.4)	36(11.9)
Neutrophil(%)	48-61	34(11.3)	141(46.6)	127(42.1)
Lymphocyte(%)	25-35	49(16.2)	211(69.9)	42(13.9)
Eosinophile(%)	0-5	0	211(69.9)	91(30.1)



**Fig. 2** Distribution of ABO blood type for subjects by age and sex.

Jawala-men: Men in Jawalakhel

Jawala-women: Women in Jawalakhel

age as shown in Figure 1.

The incidence of the abnormalities of hematological analyses are shown in Table 3. Reference ranges of the parameters for the Japanese were applied to the classification<sup>9</sup>. An old woman(61 yrs) of suspicious chronic myelocytic leukemia is included in the Table. The subject was temporarily diagnosed as anemia when more than 2 out of 3 parameters(Ht, Hb and RBC) revealed abnormally low values. Anemia was found 6.8% in Boudhanath, and in 7.0% of men and 2.6% of women in Jawalakhel, respectively. The incidence of anemia was higher in men than in women contrary to the previous study<sup>9</sup>.

**Table 4.** Mean and Standard Deviation of Morphological Parameters and Maximal Aerobic Power by Age, Sex and Area

Age Group (yrs)	n	Height (cm)	Weight (kg)	% Fat (%)	MAP (ml/kg/min)
<b>Boudhanath</b>					
20-29	118	162.8±7.2	54.0±7.7	13.8±3.8	44.2±7.4(117)
30-39	25	164.7±5.3	61.0±10.8	16.2±4.9	40.2±8.5(23)
40-49	12	162.3±9.2	63.0±9.6	18.8±5.8	34.7±5.9(11)
50-59	18	166.3±5.5	66.1±10.9	19.1±6.8	34.1±5.3(11)
60-69	20	164.5±6.0	67.1±9.8	21.9±6.8	30.7±4.9( 9)
70-	7	162.9±6.9	63.3±11.7	18.0±8.0	23.1 ( 1)
<b>Jawalakhel (Men)</b>					
20-29	66	164.7±5.6	55.5±6.5	13.2±4.1	46.2±8.0(64)
30-39	57	162.3±5.6	55.8±8.7	15.5±5.7	39.2±6.8(46)
40-49	27	163.9±6.1	60.2±11.6	16.6±7.1	34.2±5.6(23)
50-59	57	161.9±5.1	57.4±10.2	15.5±6.0	32.5±5.3(37)
60-69	27	161.9±5.9	57.4±9.5	16.0±5.1	31.2±5.3(13)
70-	5	164.7±3.2	64.5±16.3	17.0±7.0	—
<b>Jawalakhel (Women)</b>					
20-29	86	151.8±5.8	48.0±7.5	22.7±6.0	35.1±4.3(73)
30-39	63	151.6±4.7	52.2±8.3	24.1±7.6	34.8±5.3(46)
40-49	68	150.4±5.2	50.7±9.2	24.0±7.2	32.3±4.3(43)
50-59	46	150.0±6.5	54.8±10.4	24.8±7.6	30.9±3.6(13)
60-69	27	148.7±5.9	49.7±10.5	20.0±7.0	29.8 ( 4)
70-	13	144.3±4.8	44.3±7.5	17.5±7.0	—

( ) : Number of subjects measured MAP (Maximal Aerobic Power)

Remarkably high incidence of abnormalities were observed in neutrophils and eosinophiles for the differential counts, which have also been observed previously<sup>9)</sup>.

Distribution of ABO blood type by sex and area is shown in Figure 2. "B-type" was the highest incidence in Boudhanath, whereas "O-type" was the highest for both sexes in Jawalakhel.

## 2. Nutritional Survey

### 1) Subjects and Methods

The survey for the nutritional intake was carried out by 24-hour recall method using the food models. The number of the subjects surveyed was 212 in Boudhanath and 548 in Jawalakhel. To

calculate the nutrient contents more precisely and to analyse the composition of fatty acid, the measurement survey of the food intake was carried out in 33 subjects randomly selected in Jawalakhel, and the duplicated food was individually collected for two days.

### 2) Results

(1) Diet mainly consisted of Tibetan bread or tsampa, butter tea, bhat, momo, tarkari and thukpa, and occasionally of achar and dal in both areas.

(2) Almost all subjects in both areas had a habit of drinking butter tea with an average of 630 ml (120-1,300 ml) per day. Butter tea was made from butter, tea and salt. The contents of fat and

salt calculated were 3-5% and 1.0-1.3%, and their daily fat- and salt-intake were considered to be approximately 20-89g and 7-28g, respectively.

(3) The subjects in both areas took high carbohydrate diet. Protein intake seemed to be low in Jawalakhel as compared with that of the Japanese. Average animal protein ratio (22-25%) was lower and animal fat ratio (75%) was higher than those of the Japanese (45% and 45%).

(4) Cereal energy ratio was 65-70%, which was significantly higher than that of the Japanese (48%).

(5) The intakes of energy and protein per kg of body weight were 37 kcal and 0.9 g/day, respectively.

These data mentioned above were roughly estimated from 33 samples randomly selected in Jawalakhel. Further detailed analyses and calculation including fatty acid will be necessary in near future.

### 3. Morphology and Physical Fitness Survey

#### 1) Items measured

(1) Morphology : Body height, body weight and skinfold thickness (triceps, subscapular, supra-iliac, umbilical and calf) were measured, and then percent body fat (%Fat) was estimated from these values.

(2) Physical Fitness : Maximal aerobic power (MAP) was measured by Margaria's indirect method<sup>9)</sup> and 24-hour ECG was recorded using Holter ECG (SM-26; FUKUDA DENSI Co., Ltd., Tokyo, Japan).

#### 2) Subjects

Two hundred monks in Boudhanath, and 239 men and 303 women in Jawalakhel participated in the morphological survey. The subjects who received the physical fitness survey were 172 monks in Boudhanath and 183 men and 179 women in Jawalakhel, respectively.

#### 3) Results

The average body height and weight, %Fat and MAP are shown in Table 4.

The average body height of monks and Jawalakhel people was similar to that of the other Ne-

palese groups<sup>9)</sup>. The average body weight and % Fat of monks and Jawalakhel males were larger than those of the other Nepalese groups. About half of the monks were obese and the appearance rate of the obesity was higher than that of the Japanese. MAPs for the monks and men and women in Jawalakhel were lower than those for hilly villagers, but similar to those for the urban group in Nepal<sup>9)</sup> and the Japanese<sup>7)</sup>.

Further analyses including blood chemistries will be completed and the individual data will be reported as soon as possible.

### References

- 1) Dahl, L.K.: Salt and hypertension. *Am. J. Clin. Nutr.*, **25** : 231-244, 1972.
- 2) Freis, E.: Salt, volume, and the prevention of hypertension. *Circulation*, **53** : 585-595, 1976.
- 3) Itoh, K., Kawasaki, T., Uezono, K., Yoshimizu, Y., Osaka, T., Ogaki, T. and Ogata, M.: Factors affecting low serum cholesterol level in a mountain villagers in Nepal, The 14th International Congress of Nutrition, Seoul, 1989.
- 4) Kawasaki, T., Uezono, K., Itoh, K., Ogaki, T., Yoshimizu, Y., Dhungel, S. and Ogata, M.: Factors influencing blood pressure of inhabitants in mountain and suburban villages in Nepal, The 12th Scientific Meeting of the International Society of Hypertension, Satellite Symposium 21. Tokyo, 1988.
- 5) Kawasaki, T., Uezono, K., Itoh, K., Ueno, M. and Fujishima, M.: Estimation of 24-hour urinary sodium and potassium excretion from predicted creatinine and Na (or K)/creatinine ratio for second morning voiding urine. *J. Health Sci.*, **10** : 115-120, 1988. (in Japanese with English abstract)
- 6) Margaria, R., Aghemo, P. and Rovelli, E.: Indirect determination of O<sub>2</sub> consumption in man. *J. Appl. Physiol.*, **20** : 1070-1073,



- 1965.
- 7) Ogaki, T.: Maximal aerobic power, appearance rate of prohibited and stopped subjects for exercise test in Kyushu's adults. *J. Health Sci.*, **10** : 23-32, 1988. (in Japanese with English abstract)
  - 8) Pandey, M.R. and Dhungel, S.: Relation of prevalence of systemic hypertension with salt intake. *J. Nep. Med. Ass.*, **19** : 53, 1981.
  - 9) Report of comparative epidemiological studies on the genesis of hypertension in Nepal. Michihiko Ogata, ed. Institute of Health Science, Kyushu University. March, 1989. pp.1-245. (in Japanese with English abstract)
  - 10) Tobian, L.: The relationship of salt to hypertension. *Am. J. Clin. Nutr.*, **32** : 2739-2748, 1979.