

A POPULATION SURVEY ON CEREBROVASCULAR AND CARDIOVASCULAR DISEASES IN KYUSHU, JAPAN

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INTRODUCTION

On the causes of death for Japanese in Japan, cerebrovascular disease stands first, followed by neoplasma and cardiac disease comes in the third place. The list is characterized, as compared with that of the U.S.A., by the frequency of cerebrovascular disease and by far and away less frequency of ischemic heart disease. It is also noteworthy that the proportion of cerebral hemorrhage is greater than cerebral thrombosis.

In 1956, in co-operation with Prof. Ancel Keys, I joined parallel surveys on the frequency of ischemic heart disease in Fukuoka, Kyushu on the one hand, and in Hawaii and California on the other. The subjects of the survey included miners, farmers, doctors in Kyushu and Nisei's, Sansei's in Hawaii and California.

Our findings indicated a striking relationship between the dietary fats, concentration of serum cholesterol and ischemic heart disease. In the International Co-operative Study, we confirmed the predominant role played by saturated fats in diet in incidence of ischemic heart disease. However, no enlightening conclusion was reached as to the part played by the diet predominance of rice in the frequency of cerebral hemorrhage in the districts where lots of rice is produced.

At the beginning of the survey, we contemplated low protein diet resulting from Japan's traditional diet which consists mostly of rice. Our choice was a farming village subsisting on rice. As the contrast we selected a fishing village where much fish is eaten.

METHOD

In spring of 1958, a long-range population survey was started at Tanushimaru, a farming village in Kyushu. In summer of 1960, a similar survey was started in Ushibuka, a fishing village in Kyushu. (Fig. 1)

All the villagers aged 40-64 in the respective village were recruited. At entry examination, 100% of 639 persons in Tanushimaru and 99.6% of 614 in Ushibuka responded to our heartfelt thanks.

A systematic re-examination was conducted at fifth year. At tenth year, a follow-up re-examination was carried out, in spring of 1968 at Tanushimaru and in early summer of 1970 at Ushibuka. Only a small number of both cohorts were not present at the re-examination, 0.3% at Tanushimaru and 0.8% at Ushibuka. Their survival was confirmed by us.

In conducting examinations, the criteria of International Co-operative Study was observed in respect of method, equipment and criteria. The criteria of Coordinating Study sponsored by the Ministry of Education of Japan was used in the diagnosis of cerebrovascular diseases.

This report considers the data obtained from ten years comparison between two cohorts in regard to dietary habits, weight height ratio, skinfold thickness, physical activity, blood pressure, serum cholesterol and smoking habits. The comparison aimed at finding a relationship between deaths in the same period from cerebrovascular and cardiovascular diseases.

RESULTS

Nutrition (Fig. 2)

Farmers in Tanushimaru were taking reasonable total calories, their diet was low in fat and protein. Fishermen in Ushibuka were getting very high total calories, with very high protein.

The difference of diets between the two cohorts did not produce any difference in skinfold thickness. This may account for fishermen's heavier physical activity. The dietary life in both cohorts at tenth year was as it had been ten years ago.

Weight-Height Ratio, skinfold thickness (Fig. 3)

In the upper row is shown weight-height ratio. There is no definite difference in the ratio in these ten years except with advanced age group who showed a decrease in it. But skinfold thickness shown in the lower row, Ushibuka indicated a clear increase. This is understood that Ushibuka men are more prone to obesity in proportion to their earlier retirement than Tanushimaru men.

Physical Activity (Fig. 4)

This shows change of physical activity in the course of the last ten years. Compared with ten years ago, two cohorts showed no difference in the rate of persons whose physical activity was reduced by more than 50% as compared with the situation at entry examination. But the number of the retired in Ushibuka was double that of Tanushimaru.

Blood Pressure (Fig. 5)

At entry examination the mean blood pressure of Ushibuka's each age group was higher than that of Tanushimaru's. The blood pressure indicated to increase persistently more in Ushibuka than in Tanushimaru with age. At entry examination, the prevalence of systemic hypertension (blood pressure 160-95 mmHg of higher) was 15% at Tanushimaru and 22% at Ushibuka.

At tenth year examination, a similar frequency difference was observed with 9% at Tanushimaru and 13% at Ushibuka. Blood pressure was measured before and after double Master's two step test. (Fig. 6). At rest Ushibuka men had higher blood pressure than Tanushimaru men. But after exercise the farmers showed higher elevation of blood pressure than the fishermen. The old age class in Tanushimaru had 149 at rest, giving 183 after exercise, an elevation of 34 mmHg. In Ushibuka, an elevation of 23 mmHg was measured, from 161 at rest to 184 after exercise.

Smoking Habits (Fig. 7)

This shows the smoking habits in two cohorts seen at an interval of ten years. Few men began to smoke after entry examination. Smokers were more numerous in Ushibuka than in Tanushimaru with 37% of the former and 25% of the latter.

Serum Cholesterol (Fig. 8)

At entry examination, the mean serum cholesterol value at Tanushimaru was 179 mg/dl, while that at Ushibuka was 153 mg/d, about 26 mg/dl difference. During ten years there has been little fluctuation at Ushibuka but lower values were measured at Tanushimaru, the reduced figure being 37 mg/dl.

At entry examination the prevalence of serum cholesterol abnormalities (serum cholesterol 200 mg/dl or more) with Tanushimaru men were 32%, with Ushibuka men 10%. But after ten years, this relation was reversed as 4% with Tanushimaru men, 10% with Ushibuka men.

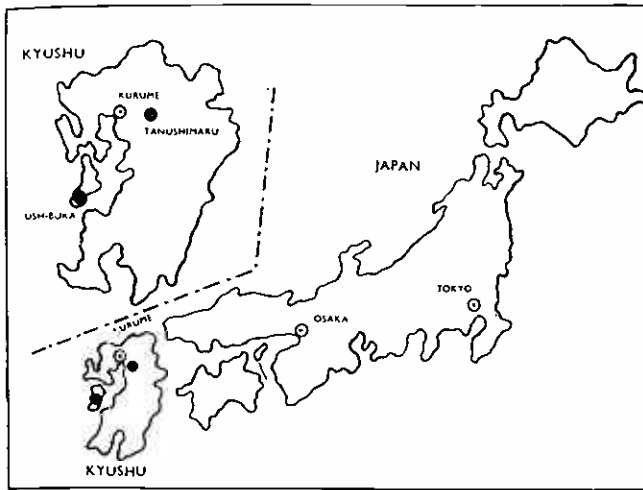


Fig. 1.

Nutrition

	Japan Average	Farmer	Fisherman
Total Cal.	2092	1994	4306
Protein (g)	69	62	247
Fat (g)	21.8	15.0	60.4
Carbohyd (g)	405	395	717
Ca (mg)	379	364	520
Vit. A (I.u)	1686	1198	2200
Vit. B ₁ (mg)	1.13	1.04	3.53
Vit. B ₂ (mg)	0.70	0.66	2.01
Vit. C (mg)	77	75	126

Fig. 2.

Changes of Weight-Height Ratio and Σ Skinfold during 10 Years

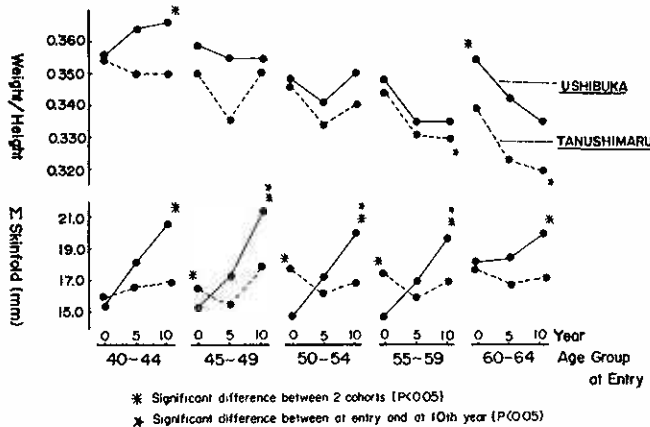


Fig. 3.

Changes of Physical Activity at 10th Year

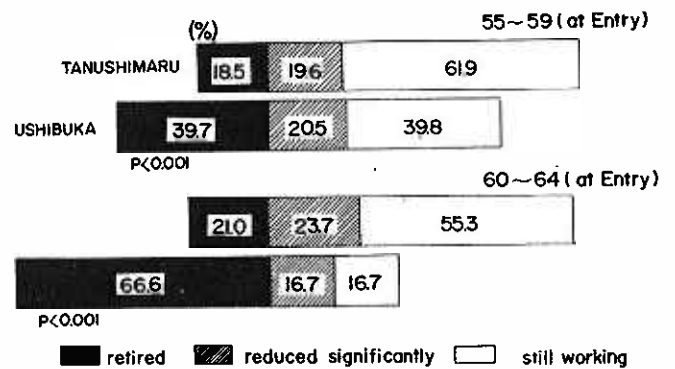


Fig. 4.

Changes of Blood Pressure during 10 Years

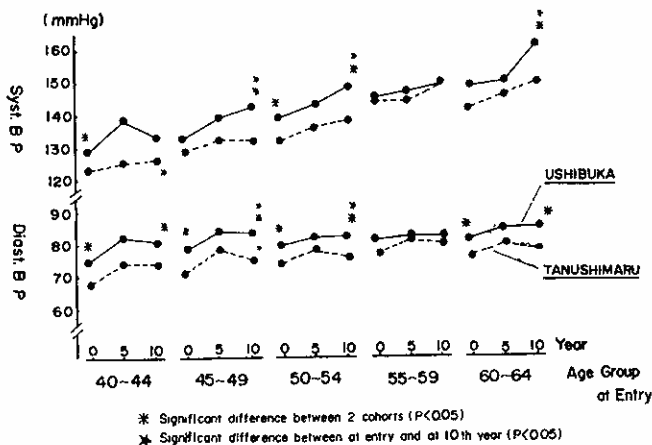


Fig. 5.

Changes of Blood Pressure after Exercise Test at 10th Year

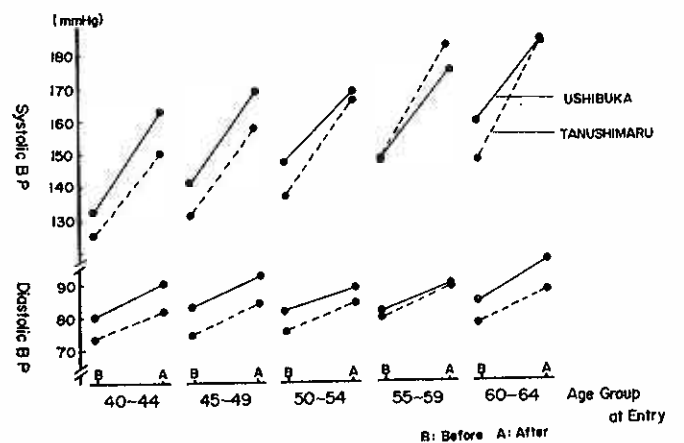


Fig. 6.

Smoking Habits

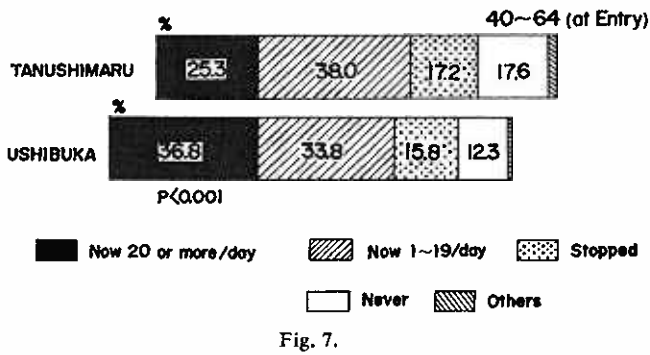


Fig. 7.

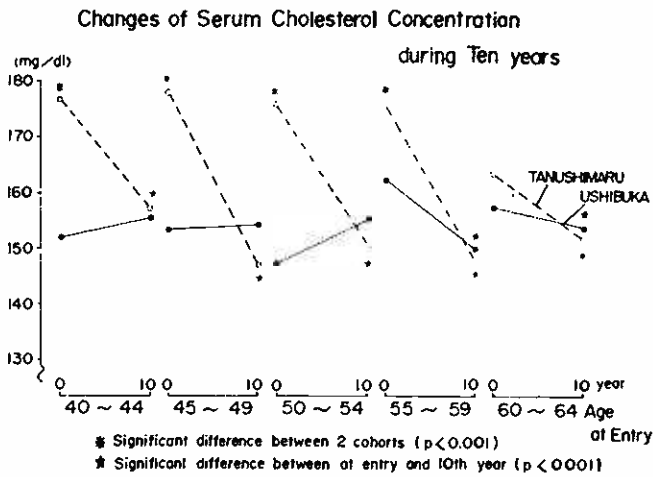


Fig. 8.

Serum Total Protein at 10th Year

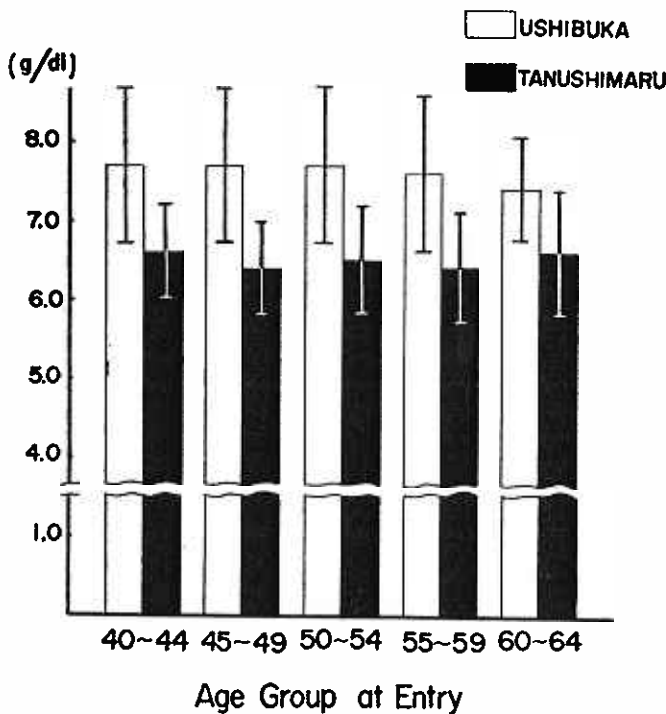


Fig. 9.

Serum Albumin-Globulin Ratio at 10th Year

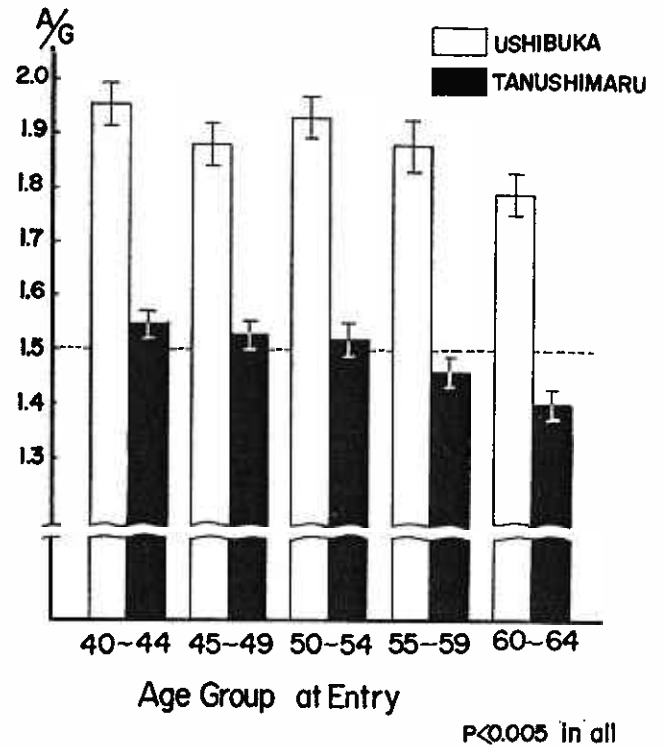


Fig. 10.

Deaths in 10 Years

	TANUSHIMARU	USHIBUKA
No. of Subjects	639	614
Myocardial Infarction	1	8
Sudden Death	2	1
Congestive Heart Failure (SHD, HHD)	7 (110)	3 (49)
Cerebral Bleeding	15 (235)	11 (179)
Cerebral Thrombosis	3 (47)	11 (179)
Thrombosis or Bleeding	6 (94)	5 (81)
Cancer of Stomach	14	14
Cancer of Liver	3	12
Others	9	10
Others	37 (579)	44 (717)
Total	97 (1519)	119 (1938)

() : Deaths per 10,000 Ages 40~64 at Entry

Fig. 11.

Serum Total Protein (Fig. 9)

This figure shows serum total protein concentration at tenth year. The farming Tanushimaru men were found to have about 18 mg/dl less serum total protein among all age groups than the fishing Ushibuka men.

Serum AG Ratio (Fig. 10)

This is the comparison of serum AG ratio between two cohorts. Tanushimaru men had clearly lower value than Ushibuka men, especially in the older age class. The rate of Tanushimaru men having abnormal value of serum total protein of less than 6.5 mg/dl was 52% while that of Ushibuka men only 5%. The situation was the same at AG ratio. The abnormal value of AG ratio less than 1.5 was found as many as 54% at Tanushimaru while at Ushibuka its rate was 15%. This finding shows the strong influences of low protein intake in farming village Tanushimaru.

Deaths in Ten Years (Fig. 11)

The observed deaths from all causes were 97 in Tanushimaru and 119 in Ushibuka. On the basis of Japan's vital statistics, in the same period, the expected deaths in two cohorts were computed, the actual death rate being 79% in Tanushimaru, and 120% in Ushibuka. Deaths from atherosclerotic events including myocardial infarction and cerebral thrombosis were 6 in

Tanushimaru and 20 in Ushibuka. Seven Tanushimaru men and three Ushibuka men succumbed to congestive heart failure. Total cerebral hemorrhage were 15 in Tanushimaru and 11 in Ushibuka.

Despite the higher prevalence of hypertension at Ushibuka, deaths from it were more frequent at Tanushimaru than at Ushibuka.

COMMENT

The following conclusion was reached from experience obtained in the course of ten year population survey in two cohorts.

1. The causative factors in myocardial infarction and cerebral thrombosis are considered to be growing obese by rather sudden reduction of physical activity on account of retirement, persisting hypertension and heavy smoking habits.
2. As for cerebral hemorrhage, the causative factors are presumed to be a sharp elevation of blood pressure after being put to exercise in addition to hypertension. Low serum protein concentration with AG ratio abnormality by the low protein diet are also accountable for incidence of cerebral hemorrhage. Moreover, low dietary protein intake may be considered to cause congestive heart failure.