



Acta Genet Med Gemellol 36:485-491 (1987)  
© 1987 by The Mendel Institute, Rome

## **Blood Pressure Discordance and Lifestyle: Japanese Identical Twins Reared Apart and Together**

**K. Hayakawa, T. Shimizu**

*Department of Public Health, Kinki University School of Medicine, Osaka, Japan*

---

**Abstract.** A total of 198 pairs of monozygotic twins reared apart and together were surveyed on their lifestyle and blood pressure through mailed questionnaires. The age of the subjects ranged from 47 to 87 years. The intrapair concordance rate on blood pressure increased from 51% (age of separation 0-5) to 78% (age of separation 26 and over) as the age of separation advanced. The concordance rate on occupation was 59% at the age of separation 0-5 and 87% at the age of separation 26 and over. The intrapair concordance on the food intake (egg, meat, fish, milk and salty seasoning) was positively correlated with the age of separation. Hayashi's quantification theory III (multivariate analysis) was used to clarify the lifestyle pattern in 39 MZ pairs discordant on blood pressure. There were three factors (meat, milk and occupation) which were closely related with each other in the "non-hypertensive" twins, while lifestyle were not patterned in the "hypertensive" twins. The concordance rate of these three items increased along with the rise of concordance rate of blood pressure as the age of separation advanced.

**Key words:** Blood pressure, Lifestyle, Twins reared apart, Epidemiology

---

### **INTRODUCTION**

Blood pressure levels are effected by lifestyle as well as by genetic factors [1,3]. In the development of one's lifestyle, familial environments in childhood play a very important role. Identical twins reared apart may provide a powerful research method to clarify the magnitude of familial environments. The comparison of monozygotic (MZ) twins separated at different ages may provide useful information to identify the influential age period for each factor.

We have conducted a questionnaire survey on health conditions of adult twins. In

this paper, blood pressure levels and lifestyle factors are analysed in 198 MZ pairs reared apart and together.

## MATERIALS AND METHOD

### Subjects

Subjects are the 198 MZ twin pairs taken from Kinki University Adult Twin Registry consisting of 1,314 pairs [4]. The number of twin pairs registered in this panel is gradually increasing. The age of the subjects ranges from 47 to 87 years. Age of separation is shown in the Table. Age of separation means the age when the twins started to live apart. There were 15 MZ pairs separated at the age 0-5, 39 MZ pairs at the age 11-15, 63 MZ pairs at the age 16-20, 45 MZ pairs at the age 21-25, and 36 pairs at the age 26 and over.

Table - Age at the time of separation in the male MZ twins

Separation age	0-5	6-10	11-15	16-20	21-25	26 and over
Number of pairs	15	0	39	63	45	36

### Method

A questionnaire survey was conducted by mail. The questionnaire included 40 items. The items analysed in this study are as follows:

1. Have you been ever told you were "hypertensive" by a physician? (Yes, No)
2. Have you been ever told you were "hypotensive" by a physician? (Yes, No)
3. How old were you when you started to live apart from your twin brother/sister?
4. How much are you satisfied with your life in the past and the present? (Low 1 - 2 - 3 - 4 - 5 High)
5. How active were you in sports when you were young? (1 Active, 2 Ordinary, 3 Inactive)
6. What is the occupation in which you have been engaged longest?
7. How often do you eat each of the following foods: Meat, Fish, Egg, Milk? (Everyday, 2-3 times/week, rarely)
8. Do you prefer salty seasoning (traditional seasoning) or saltless seasoning? (1 Salty, 2 Ordinary, 3 Saltless)
9. Do you smoke more than 20 cigarettes a day on the average? (Yes, No)
10. Do you drink alcohol everyday? (Yes, No)
11. When growing up, were you and your twin often said to be as like as two peas in a pod? (Yes, No).

All subjects answered "Yes" to item 11 and were consequently diagnosed to be MZ.

### Multivariate Analysis

Hayashi's quantification theory III (pattern classification) [5] was used to analyse the questionnaire results. This theory is one form of multivariate analysis and is based upon the prediction theory of Guttman. Hayashi's quantification theory is considered to be very similar to the dummy variable method of multivariate analysis which is often used in the USA. Its usage is similar to that of principal component analysis or factor analysis. This theory aims at classifying variables and identifying major variables. In this study, Hayashi's theory was used since it enables to visualize the positional relation among many variables in a multidimensional space.

### RESULTS AND DISCUSSION

Concerning blood pressure, the subjects were clustered into three groups: high, normal and low, based on the results of the questionnaires. The intrapair concordance on blood pressure was calculated in these groups. Fig. 1 shows the observed and expected rates of intrapair concordance on blood pressure in the MZ twins separated at different ages.

The observed rate of intrapair concordance on blood pressure increased from 51% (age of separation 0-5) to 78% (age of separation 26 and over) as the age of separation advanced. On the other hand, the expected rate remained around 40% for all ages of separation. This indicates that living in the same family environments in younger age effected the intrapair concordance rate of blood pressure in adulthood. It is considered that the lifestyle developed in younger age has a great influence on the lifestyle in later adulthood.

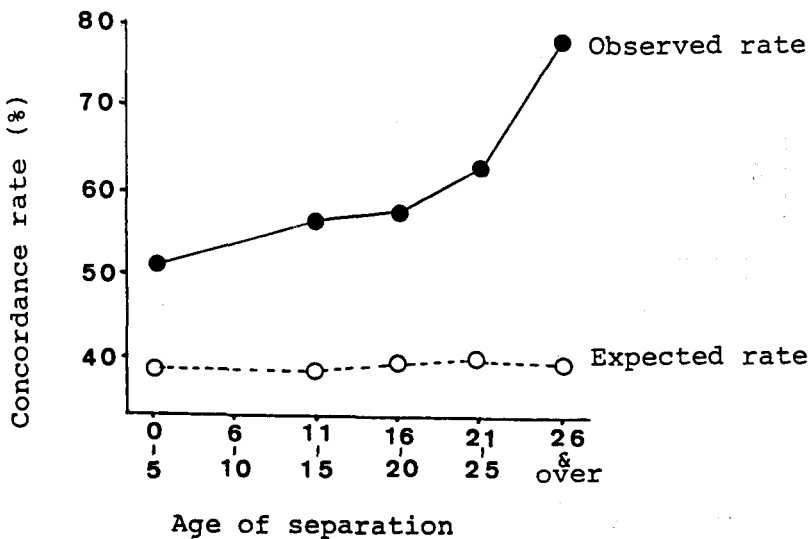
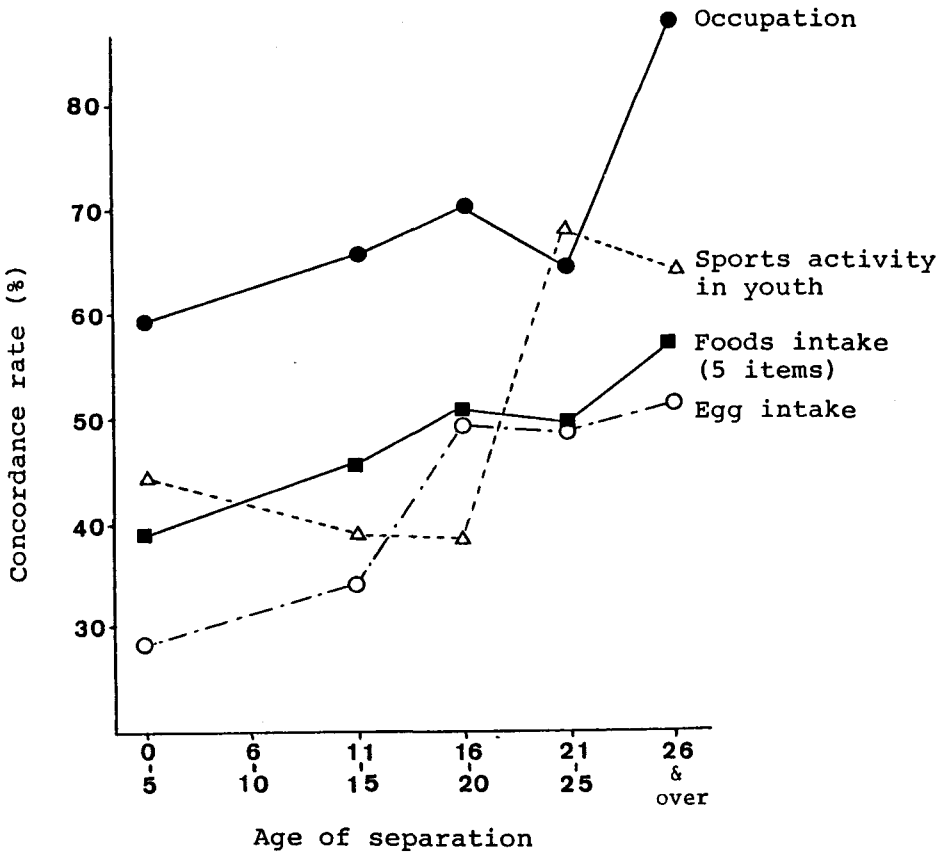


Fig. 1 - Intrapair concordance of blood pressure and the age of separation

Fig. 2 shows how the intrapair concordance rates of lifestyle factors changed as the age of separation advanced. The lifestyle factors examined in Fig. 2 are occupation, sports activity in youth, food intake (5 items) and egg intake.

Concerning occupation, the subjects were clustered into two groups: white-collar work (professional or clerical works) and the other works. The intrapair concordance on occupation was calculated in these two occupational groups. The concordance rate was 59% at the age of separation 0-5 and 87% at the age of separation 26 and over. The choice of occupation seems to be under the influence of family environment in younger age.

Concerning the intrapair concordance of sports activity in youth, the subjects were clustered into three groups: active, ordinary and inactive. The concordance rate stayed



Occupation was divided into two groups (white-collar and the others).

The concordance rate of foods intakes shows the mean rate among 5 items (egg, milk, meat, fish, and salty seasoning).

Fig. 2 - Intrapair concordance of lifestyle factors and the age separation

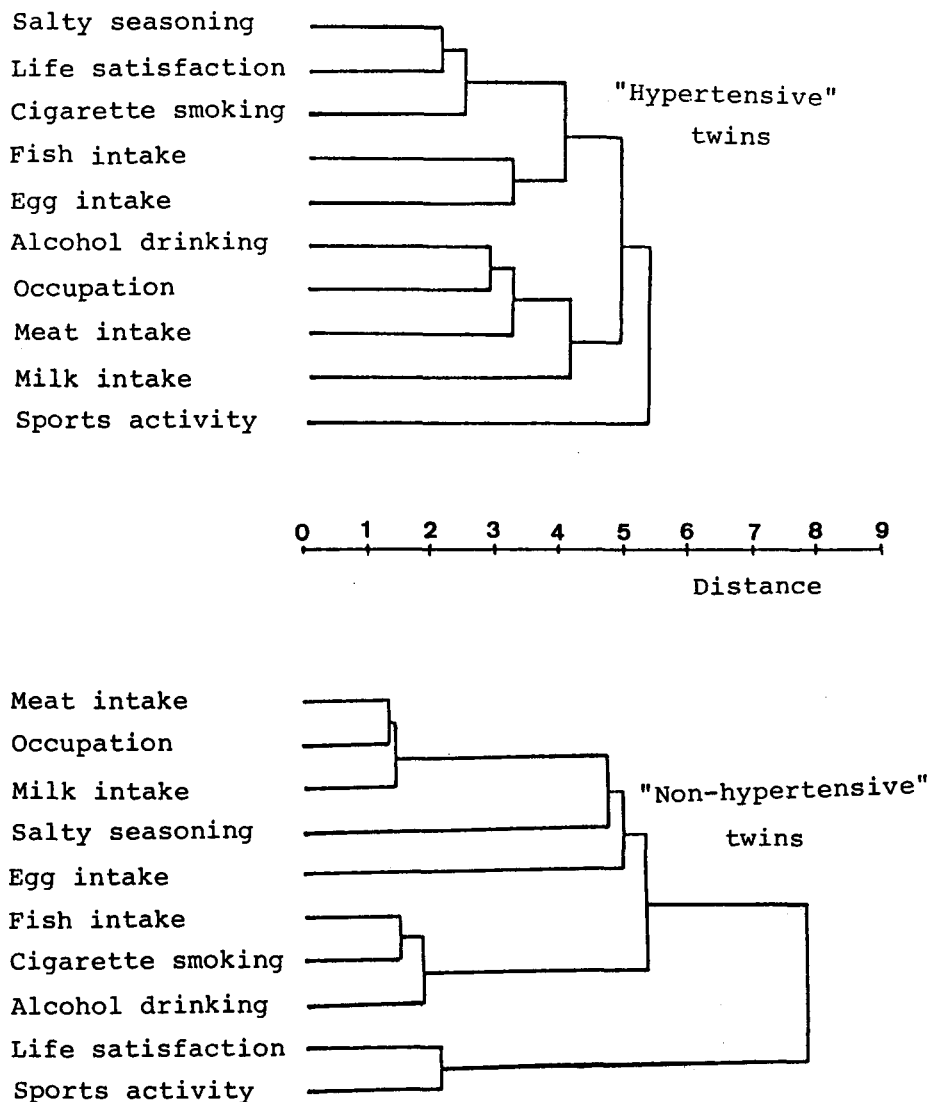


Fig. 3 - Dendrogram of lifestyle factors in the male MZ twins discordant in blood pressure

around 40% from the age of separation 0-5 to 15-20, but was much higher (60-65%) at the age of separation 21-25 and 26 and over).

The intrapair concordance on the intake frequency of 5 food items was also shown in Fig. 2. These food items were egg, meat, fish, milk and salty seasoning. Fig. 2 shows the mean values of intrapair concordance on these 5 items. The concordance rate was 39% at the age of separation 0-5, and 56% at the age of separation 26 and over. The concordance rate was positively correlated with the age of separation. It was indicated that food intake

was affected by family environment in younger age.

The intrapair concordance on intake frequency of egg was also shown in Fig. 2. The concordance rate was slightly lower than that of food intake (5 items) at each groups of age of separation.

A total of 39 pairs were discordant for hypertension, based on the twins reports.

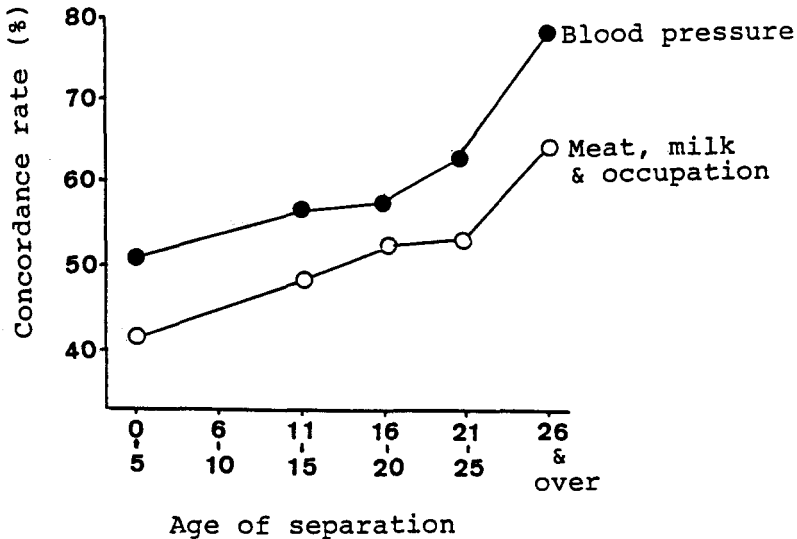


Fig. 4 - Mean rate of intrapair concordance in meat and milk intake and occupation

Fig. 3 shows the results of multivariate analysis (Hayashi's quantification theory III) on the lifestyle factors in these 39 MZ pairs. The results are shown in the dendrograms (Fig. 3) by the nearest neighbour method [6].

There was no cluster of items in which a close positional relation was seen between the items in the "hypertensive" twins. On the other hand, there were three items (meat intake, milk intake and occupation) which showed a close relation in the "non-hypertensive" twins. Besides these three, there were three other items which also showed a relatively close relation: fish intake, cigarettes smoking and alcohol drinking. The former three items seem to represent a westernized lifestyle among the Japanese, while the latter three items seem to represent a traditional Japanese lifestyle. It is considered that the lifestyle items were not patterned in the "hypertensive" twins, while there was a certain pattern in the lifestyle among the "non-hypertensive" twins.

The intrapair concordance rates were compared between the blood pressure and the three items of lifestyle (meat intake, milk intake and occupation) which showed a close relation in the "non-hypertensive" twins. Fig. 4 shows the results of the comparison. The mean concordance rate of these three items was 41% at the age of separation 0-5 and then increased to over 60% as the age of separation advanced. The rate of increase showed a great similarity between the blood pressure and these three items of lifestyle. This similarity indicates a close relation between blood pressure and certain lifestyle factors.

## REFERENCES

1. Dyer K (1977): Alcohol consumption, cardiovascular risk factors, and mortality in two Chicago epidemiologic studies. *Circulation* 56:1067-1074.
2. McIlhany ML, Shaffer JW, Hines JSE (1975): The heritability of blood pressure; an investigation of 200 pairs of twins using the cold pressor test. *Johns Hopkins Med J* 136:57-64.
3. Feinleib M, Garrison RJ, Fabsitz R, et al (1977): The NHLBI twin study of cardiovascular disease risk factors; methodology and summary of results. *Am J Epidemiol* 106:284-295.
4. Hayakawa K, Shimizu T, Ohkuni M, et al (1983): Gerontological research on aging twins (Second report): results of the health survey through questionnaires. *Jpn J Publ Health* 30:349-357.
5. Hayashi C, Matsushita Y, Uematsu T, et al (1973): *Multivariate Analysis and Quantification*. Tokyo: National Institute of Statistical Sciences, pp 2-61.
6. Okuno T, Yoshiga T, Yagima K, et al (1978): *Multivariate Analysis*. Tokyo: Nikkagiren, pp 212-213.

**Correspondence:** Dr. K. Hayakawa, Department of Public Health, Kinki University School of Medicine, Osaka, Japan.