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Relationship Between Blood Uric Acid Level and Personality Traits

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Abstract. The present study deals with the relationship between blood uric acid level and human behavior. Subjects were 37 MZ and 7 DZ twins aged from 18 to 45 years. In males, blood uric acid level increased with age, while it decreased with age in females. Blood uric acid level was corrected and standardized using regression lines separately for males and females. The distribution of standardized uric acid level corresponded well with the theoretical curve of normal distribution. The intraclass correlation coefficient for standardized uric acid level was $r = 0.370$ ($P < 0.05$) for the 37 MZ twins, but not significant for the 7 DZ twins. These findings suggest that blood uric acid level is genetically controlled. By the analysis of 12 personality traits in YG (Yatabe-Guilford) character test, it was revealed that "General activity" was more controlled by genetically than environmentally. In the evaluation of the correlation between standardized uric acid level and the YG 12 personality traits, significant correlation was observed in "Lack of agreeableness" and "Rhathymia". Since these two personality traits include the factor of "activity", it is concluded that the plasma uric acid level and activity in a broader sense are under genetic control. This conclusion is consistent with the generally accepted view that persons with high uric acid level are more active and energetic than those with low level.

Key words: Uric acid, Twins, Personality traits

Uric acid is the end product of purine metabolism in man. Nearly since 1950, it has been said that "those who are in high blood uric acid level are in general more active" [1-9,11]. Many studies were performed with respect to this idea, but not all

included a genetic analysis. The present study attempts a genetic analysis of this hypothesis using twin subjects.

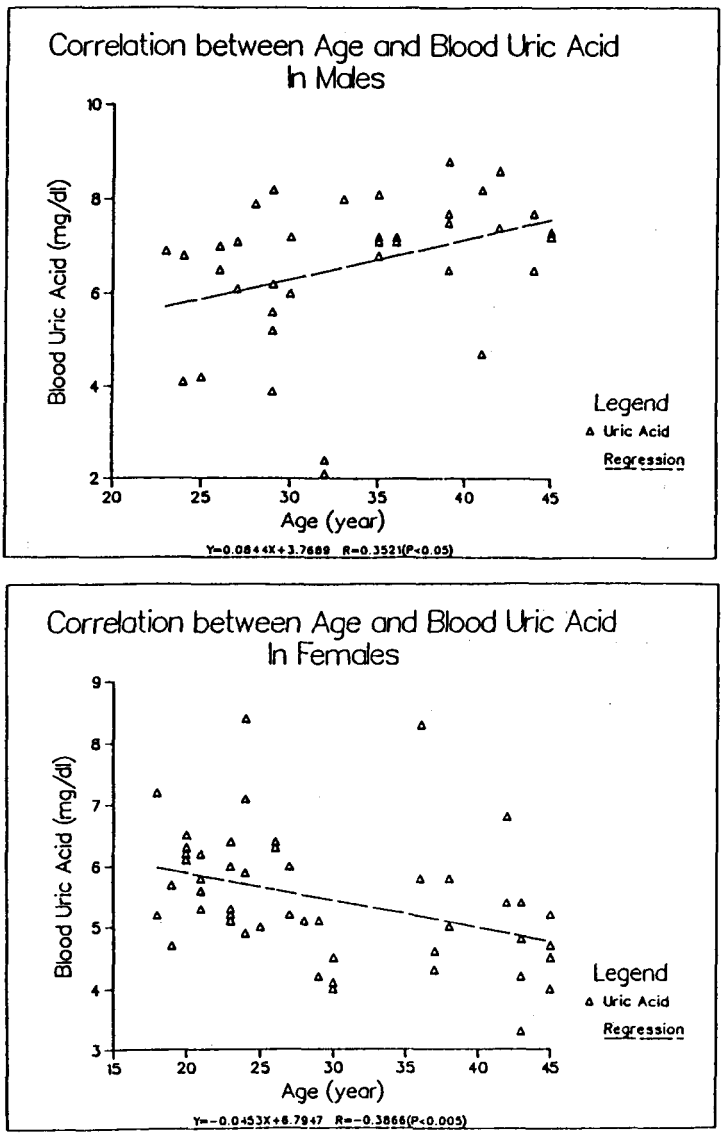

Fig. 1. Plasma uric acid levels by sex and age.

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MATERIALS AND METHODS

Subjects were 44 pairs of twins, 37 MZ and 7 DZ, who graduated from the senior high school affiliated to the University of Tokyo. There were 39 males, aged 23-45 years (mean 33.5 and SD 6.5), and 49 females, aged 18-45 years (mean 29.5 and SD 9.0). Heparinized blood was taken, and uric acid was measured by colorimetric method on the same day. This study was part of the follow-up studies concerning medical examinations for adult diseases. The study addressed first the genetic analysis of plasma uric acid level, then the analysis of Yatabe-Guilford character test (YG-test), and finally the relationship between plasma uric acid level and YG 12 personality traits.

RESULTS

It has been generally recognized that plasma uric acid level depends upon sex and age [5,9,10]. Plasma uric acid level by sex and age in this study are shown in Fig. 1. Uric acid level increased with age in males, and decreased with age in females. For simplicity, we assumed a linear regression of uric acid level on age separately for males and females. Next, we corrected each measurement to a fixed age using the slope of the regression equation again separately for males and females. And finally, the corrected values were standardized with mean 0 and SD 1.

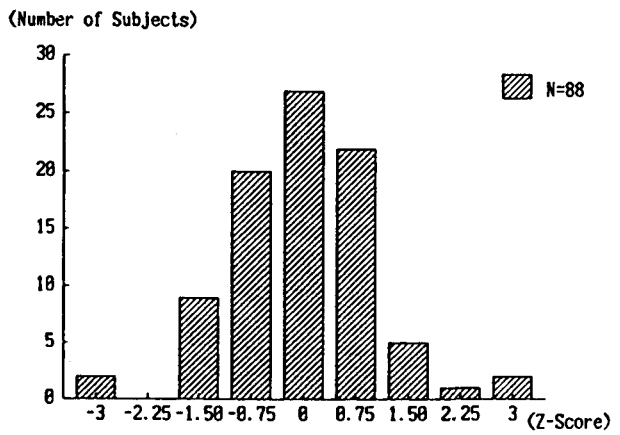

Fig. 2. Distribution of plasma uric acid level (standardized data).

Fig. 2 shows a distribution of corrected and standardized plasma uric acid level. Histogram was in a good agreement with the theoretical curve of normal distribution. Table 1 shows the intraclass correlation coefficient of standardized plasma uric acid level for MZ twins, DZ twins and random pairs. Random pairs were constructed so that the pair members were not related with each other. Significant correlation was seen in MZ, but not in DZ and random pairs.

Table 1 - Intraclass correlation coefficient of standardized plasma uric acid level.

MZ pairs	(N = 37)	0.370	P < 0.05
DZ pairs	(N = 7)	–0.167	
Random pairs	(N = 44)	–0.134	

The YG-test was modified and reformed by Yatabe and Tujioka based on the original study of Guilford. This is a test concerning 12 personality traits, which includes 120 questions. The 12 traits are as follows: "Depression", "Inferiority feeling", "General activity", "Nervousness" and so on, as shown in Table 2. The raw score of each trait ranges from 0 to 20. And the higher the score, the stronger the tendency of that personality trait. This test is now widely used in Japan as one of the best character tests by questionnaire in the field of education and medical science.

Table 2 - 12 Personality traits in YG-Test

Depression	Gloomy, dismal melancholy, pessimistic
Cyclic tendency	Be apt to be agitated, notable change of mood
Inferiority feeling	Lacking in self-confidence, underestimation of oneself
Nervousness	Anxious, feel uneasy, nervous, fear, solicitous
Lack of objection	Fanciful, imaginative, subjective, hypersensitivity
Lack of cooperativeness	Dissatisfied, discontented
Lack of agreeableness	*Aggressive, social activity*
General activity	Lively, brisk, active, full of life
Rhathymia	Easy, light-hearted, cheerful, *active, impulsive*
Thinking extraversion	Not deliberate, not meditative, unreflecting
Ascendance	Social leadership
Social extraversion	Sociable, friendly, amicable

Table 3 - Intraclass correlation coefficient of YG 12 personality traits

YG 12 personality traits	MZ pairs (N = 37)	DZ pairs (N = 7)	Random pairs (N = 44)
Depression	0.3430*	0.3676	0.0032
Cyclic tendency	0.2548	0.2106	–0.0006
Inferiority feeling	0.6092***	0.2551	0.0429
Nervousness	0.3552*	0.0231	0.0506
Lack of objection	0.4231**	–0.1623	–0.1146
Lack of cooperativeness	0.2510	0.3799	–0.0519
Lack of agreeableness	0.2852	0.0123	–0.1643
General activity	0.6680***	–0.6994	0.0388
Rhathymia	0.4237**	0.4385	–0.0706
Thinking extraversion	0.4209**	–0.1361	–0.0280
Ascendance	0.6963***	0.0217	0.0647
Social extraversion	0.5492***	–0.6002	–0.0743

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

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Table 3 shows the intraclass correlation coefficient of YG 12 personality traits for MZ, DZ and random pairs. As to MZ, 9 personality traits were significant, but there were no significant traits in DZ and random pairs. Moreover, "General activity" and "Ascendance" were significant in both MZ males and females.

Table 4 - Correlation coefficient between standardized plasma uric acid level and YG 12 personality traits

YG 12 personality traits	Total twins (N = 88)	Male twins (N = 39)	Female twins (N = 49)
Depression	−0.0078	−0.0068	−0.0086
Cyclic tendency	0.0217	0.1856	−0.1229
Inferiority feeling	−0.0526	−0.0070	−0.0924
Nervousness	−0.0375	−0.0737	−0.0090
Lack of objection	0.1102	0.1491	0.0864
Lack of cooperatveness	0.1541	0.2325	0.0912
Lack of Agreeableness	0.2145*	0.3009*	0.1453
General activity	0.0811	0.1842	0.0290
Rhathymia	0.1771*	0.3182**	0.0774
Thinking extraversion	−0.0239	−0.0243	0.0238
Ascendance	0.0103	−0.0068	0.0249
Social extraversion	0.0165	0.1414	−0.0707

* $P < 0.05$; ** $P < 0.025$.

Table 4 shows the correlation coefficient between corrected and standardized plasma uric acid level and YG 12 personality traits. It is seen that "Lack of agreeableness" and "Rhathymia" showed significant correlation.

DISCUSSION AND CONCLUSION

The findings observed in this study suggest that the variation of plasma uric acid level is under genetic control and additive effect of polygenes may play a role. To evaluate the influence of environmental factors, intraclass correlation coefficients of MZ twins were calculated in situations where the twins were married or not married or lived together or separately. However, no significant difference could be found. Moreover, the within-pair absolute difference in the standardized plasma uric acid also failed to show any age influence. These findings suggest that the influence of environmental factors is not so important. The heritability of plasma uric acid level was estimated by Holzinger's method. The estimated value was $h^2 = 0.433$. For the same subjects, many other anthropological or biochemical items were measured. The results showed that this value was much lower than that of height ($h^2 = 0.894$), free cholesterol ($h^2 = 0.774$), Al-p (alkaline-phosphatase) ($h^2 = 0.757$), nearly the same as that of triglyceride ($h^2 = 0.424$), and much higher than that of GPT (glutamic-pyruvic transaminase) ($h^2 = 0.025$). Surely, the value itself does not mean accuracy because of small sample size and simple genetic model, but moderate heritability of plasma uric acid level.

With respect to YG-test, two personality traits, namely, "General activity" and "Ascendance", show more similarity in MZ of both sexes than in DZ twins, and may therefore be more controlled by genetically than environmentally.

Standardized uric acid level has appeared to be significantly related to "Luck of agreeableness" and "Rhathymia". These two personality traits have a close relationship with "General activity", and include factors concerning activity of personality (italics in Table 2).

Therefore, these findings indicate that plasma uric acid level and activity in a broader sense are under genetic control, and support the view that "those who are in high blood uric acid level are in general more active" [1-9,11].

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