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Hyperuricemia in Ilan County

Introduction

The Field Epidemiology Training Program was informed by the Ilan County Health Bureau in April 1991 that some suspected cases of high serum uric acid were found among some elderly persons of Tung-Au Census Trocts , Su-Au Township in a physical examination by the St. Mary Hospital of Lotung. In January 1991, the FETP, while conducting an epidemiological investigation of hepatitis A in Tung-Yueh Village neighboring Tung-Au Census Tracts, had also found some suspected gouty arthritis cases. An investigation in both Tung-Au Census Tracts and Tung-Yueh Village was thus decided upon. The investigation, because of time and manpower limitations, was to be conducted on a voluntary basis. The purpose was to understand the level of serum uric acid among persons examined and to identify risk factors related to hyperuricemia.

Material and Method

Tung-Au Census Tracts and Tung-Yueh Village are both in Ilan County facing the Pacific Ocean and separated by the Sh-Hua Highway. Tung-Au comes under Su-Au the jurisdiction of Township. The population above the age of 20 years, based on household registration information, is 450, though in fact only 250 live there. They are primarily Fukienese engaged in fishing and agriculture. The neighboring Tung-Yueh comes under the jurisdiction of Nan-Au Township. The population above the age of 29 years, based on household registration information, is 320, though only 220 persons live there. They are primarily the Atayals. Villagers above the age of 20 years in the two a reas were interviewed twice on a voluntary basis. The questionnaire includes: background information, risk factors related to hyperuricemia, and initial assessment and diagnosis by physician of arteritic symptoms in the first interview. Blood testings include value of serum uric acid blood sugar before eating, creatinine, cholesterol, and triglyceride. Body height, weight and blood pressure were also measured. The biochemical value of blood was examined by a St Mary Hospital with Hitachi-705.

Hyperuricemia is defined as: 7.7 mg/dl and higher for men, and 6.6 mg/dl and higher for women. Clinical gouty arthritis is defined as: history of typical acute arthritic pain on toe or foot joints or typical sedimentation of gout stone and hyperuricemia at the same time. Measured value is shown with the average value $\pm$ standard deviations. The values are tested by Student's t-test, and each variable on the questionnaire is analyzed with chi-square test.

Findings

A total of 148 persons were examined: 105 in Tung-Au and 43 in Tung-Yueh (see Table 1). The mean values of serum uric acid for Tung-Au residents are 7.05 mg/dl for men and 5.56 mg/dl for women; those for the Tung-Yueh residents are 10.50 mg/dl for men and 8.14 mg/dl for women. The prevalence rates of hyperuricemia in Tung-Au are 29.2% for men and 19.3% for women; those in Tung-Yueh are higher than 85% for both sexes. In terms of age, the mean value of uric acid is the highest in the 40-49 age group; higher for men, and higher in Tung-Yueh (see Table 2). In the first investigation, only one man in Tung-Au was diagnozed as having clinical gouty arthritis; the average prevalence rate of gout in Tung-Yueh was 44.4% (see Table 3). On each variable analyzed, the average values of triglyceride, cholesterol and creatinine among hyperuricemia cases are higher than persons of normal uric acid level (see Table 4). In addition, significant difference is also found in body weight, body mass index (BMI) and diastolic pressure. Hyperuricemia is found to be positively related to ethnic groups and drinking habit (see Table 5).

Discussion

Uric acid is the end product of purine metabolism. In normal persons, the level of serum uric acid remains relatively constant as the production and excretion rates of uric acid are often balanced. Many studies have shown that the average value of serum uric acid for men is around 5.0-5.7 mg/dl, and that for women, 3.7-5.0 mg/dl. When the uric acid value exceeds 7.0 mg/dl for men and 6.0 mg/dl for women, the persons are considered hyperuricemic. This definition agrees with the fact that uric acid, under 37 ℃ and at 7 mg/dl in the blood, becomes saturated and crystallized, and therefore, is generally accepted. Under this definition, 2-18% of the population in European and American countries, are estimated to be hyperuricemic. However, recently, some scholars have adopted a stricter definition of hyperuricemia and accept uric acid levels above 7.7 mg/dl for men and 6.6 mg/dl for women as the criteria. There are no previous data on the average levels of serum uric acid for Chinese in Taiwan. The Veteran's General Hospital in 1974, after examination of 11,000 hospitalized patients, found the average level of serum uric acid was 5.3 ± 1.35 mg/dl for men and 3.60 ± 1.84 mg/dl for women. A study by the Yang-Ming Medical College in 1988 in Pu-Li Township showed an average value of uric acid of 6.38 ± 1.84 mg/dl for men and 5.15 ± 1.47 mg/dl for women. Based on these findings, the present study adopts the stricter criteria for hyperuricemia.

Of the 105 residents of Tung-Au (average age 51 years), the mean value of serum uric acid for men is 7.05 mg/dl, and for women, 5.56 mg/dl. Although these values are higher than those of Pu-Li (6.38 mg/dl for men and 5.15 mg/dl for women), no statistically significant difference is found between the prevalence rates of hyperuricemia in Tung-Au and Pu-Li under the strict criteria (29.2% vs 20.3% for men and 19.3% vs 14.6% for women). As the present study is not a sampling survey, there could be selection bias because participants of the study tend to be older and persons already sick were more likely to participate. The mean value of uric acid thus is higher. Of the 64 Tung-Au residents examined in the first interview, only one man was found to have a history of gout and hyperuricemia. By this estimate, the prevalence rates of hyperuricemia and gout in

Tung-Au should not be significantly higher than those of Pu-Li. Of the 43 Tung-Yueh residents examined (average age 53 years), the mean value of uric acid is as high as 9.2 mg/dl, and 16 of them have history of gout asnd hyperuricemia (44%). Although the number of participants from Tung-Yueh was fewer and the values could have been overestimated, the value of serum uric acid and the prevalence of gout in Tung-Yueh, a village of primarily Atayals, are definitely higher.

A review of literature show that some ethnic groups in the South Pacific seem to have higher prevalence rates of hyperuricemia and gout. For instance, Polynesians such as the Maoris of New Zealand, Raratongans and Pukapukans of the Cook Islands and Samoae, Micronesians on Nauru, Mirianas and the Marshalle Islands, the aboriginees on Australia, and the Melanesians on the highlands of Papua New Guinea have higher rate of hyperuricemia and gout. Men on Nauru have a high mean value of uric acid of 7.5 mg/dl, and that for Maori men on New Zealand is 7.06 mg/dl; their prevalence rates of gout are 6.9% and 10.4%, respectively. Because the aboriginees of Taiwan are descendents from the Malayo-Polynesian group, we thus suspect that the Atayals of Nan-Au Township are likely to have higher levels of serum uric acid and that ethnic genetic factors might play an important role in this case.

While the major cause of hypereuricemia is primary metabolic disorders of unknown reason, other secondardy causes can also increase the level of uric acid. For instance, the absence of certain enzymes, certain blood diseases, defects of kidney function and the use of diuretics are some of the secondary causes. In the epidemiological studies on the risk factors related to hyperuricemia, body weight or the body mass index (BMI) are generally accepted to be major risk facotrs. Triglyceride and ceatinine in blood are also positively related to the level of serum uric acid. Some studies believe that urice acid value is related to cholesterol, but other studies say that the relation between the two is not significant. The current view on the issue of blood sugar and uric acid is that hyperuricemia is negatively related to diabetes, but is positively related to the malfunction of glucose tolerance. The Framingham study in USA shows that the level of serum urice acid is significantly related to blood pressure and that persons of higher uric acid level are more likely to develop coronary heart disease. The present study has found that the body weight, BMI, diastolic pressure, and creatinine, cholesterol and triglyceride in blood are higher in persons of high uric acid; though no significant difference is found in blood sugar and systolic pressure. Consumption of alchol increases the level of serum uric acid and is likely to induce gout. As to the level of uric acid or gout and diet, Loenen's study shows that uric acid level is positively related to the frequent intake of meat and fish. Our study shows that hyperuricemia is significantly related to drinking babits, but not to smoking, betel-nut chewing, and frequent intake of meat or beans. Findings of the present study on risk factors are relatively similar to the findings of studies in other countries.

Although body compositions and environmental factors have impacts on the level of serum uric acid, many scholars are of the opinion that genetic factors of multiple-gene type are the major reasons of hyperuricemia and that environmental factors play a more important role in the development of gout. For the treatment of asymptomatic hyperuricemic patients, in addition to the control of body weight, blood pressure and diet, most scholars are relatively conservative, that is, unless there are symptoms or a clear

family history of gout, drug therapy will not be considered. It should be noted that because the present study is not designed as a sampling survey, the findings can not apply to either Tung-Au or Tung-Yueh as a whole.

We suggest that persons of higher uric acid level should control body weight, restrict drinking alchol and observea balanced diet. If the person is also hypertensive, blood pressure should be controlled and the dosages of diuretics and other hypertension drugs should be adjusted. As to the level of serum uric acid and the Atayal people, further studies are suggested.

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Table 1. Prevalence Rates of Hyperuricemia, Tung-Au and Tung-Yueh

Locality	Sex	No. Examined	Average Age	Average Level of Serum Uric Acid (mg/dl)	Hyperuricemia Prevalence (%) *	**
Tung-Yueh	Male	20	51.6±11.9	10.50±2.57	90.0 (18)	85.0 (17)
	Female	23	55.4±12.2	8.14±1.93	95.7 (22)	91.3 (21)
	Total	43	53.7±12.0	9.24± 2.52	93.0 (40)	88.4 (38)
Tung-Au	Male	48	57.7±15.6	7.05±1.30	48.0 (23)	29.2 (14)
	Female	57	46.6±16.5	5.56±1.46	33.3 (19)	19.3 (11)
	Total	105	51.7±17.0	6.24± 1.57	40.0 (42)	23.8 (25)

Criteria for hyperuricemia: * for men, >7.0 mg/dl; for women, ≥6.0 mg/dl.
** for men, ≥7.7 mg/dl; for women, ≥6.6 mg/dl.

Table 2. Level of Serum Uric Acid (mg/dl) by Sex and Age, Tung-Au and Tung Yueh

Age	Tung-Yueh (N=43)		Tung-Au (N=105)	
	Male	Female	Male	Female
20-29	—	—	6.83±0.85 (4)	5.44±0.91 (9)
30-39	11.40±1.31 (2)	5.85±2.48 (2)	7.38±1.14 (4)	4.96±1.10 (14)
40-49	12.00±3.27 (5)	8.80±1.28 (5)	8.43±1.61 (6)	5.60±1.65 (10)
50-59	11.03±1.40 (6)	8.41±2.27 (9)	6.38±0.76 (9)	5.43±1.25 (12)
60-69	8.27±2.20 (6)	6.95±0.71 (4)	6.39±1.09 (14)	6.65±2.20 (8)
>70	—	9.30±1.31 (3)	7.26±1.45 (11)	6.03±1.47 (4)

Table 3. Prevalence Rates of Hyperuricemia and Gouty Arthritis at First Investigation

Locality	Sex	No. Examined	Prevalence of Hyperuricemia (%) *	**	Prevalence of Gouty Arthritis (%)
Tung-Yueh	Male	15	100.0 (15)	93.3 (14)	73.3 (11)
	Female	21	100.0 (21)	95.2 (20)	23.8 (5)
	Total	36	100.0 (36)	94.4 (34)	44.4 (16)
Tung-Au	Male	34	44.1 (15)	26.5 (9)	2.9 (1)
	Female	30	30.0 (9)	13.3 (4)	0 (0)
	Total	64	37.5 (23)	20.3 (13)	1.5 (1)

Criteria for hyperuricemia: * for men ≥7.0 mg/dl; for women, ≥6.0 mg/dl
** for men ≥7.7 mg/dl; for women, ≥6.6 mg/dl.

Table 4. Hyperuricemia Cases and Normal Persons by Variables

Variable	Hyperuricemia Cases (N=63)	Persons with Normal Serum Uric Acid (N=85)	p Value
Uriceacid (mg/dl)	9.08±2.09	5.65±1.10	
Age (years)	53.20±13.9	51.2±16.6	NS†
Creatinine (mg/dl)	1.06±0.28	0.93±0.23	<0.01
Blood sugar before eating (mg/dl)	100.3±29.8	96.0±23.6	NS
Cholesterol (mg/dl)	227.3±61.7	191.5±35.7	<0.001
Triglyceride (mg/dl)	233.9±281.4	122.4±120.4	<0.001
Height (cm)	158.0±8.2	157.3±7.7	NS
Body wieght (kg)	62.6±13.4	57.3±8.0	<0.01
BMI (kg/M^2)*	25.1±4.4	23.2±3.0	<0.001
Diastolic pressure (mmHg)	125.2±21.1	119.1±20.0	NS
Systolic pressure (mmHg)	80.5±11.3	71.7±10.6	<0.0001

†NS: Not significant

*BMI=Body wieght (kg)/Height $(m)^2$, BMI$\geq$30 kg/M^2 is considered obesive.

Table 5. Level of Serum Uric Acid by Variables

Variables	Level of Serum Uric Acid		X^2	p Value
	High	Normal		
Sex				
Female	31	37	0.47	NS
Male	32	48		
Ethnic group				
Aboriginees	38	0	68.98	<0.0001
Non-aboriginees	25	85		
Education*				
Low	45	59	0.02	NS
High	16	22		
Drinking				
Yes	36	18	20.54	<0.0001
No	26	66		
Smoking				
Yes	19	27	0.04	NS
No	44	58		
Betel-nut chewing				
Yes	11	8	2.09	NS
No	52	77		
Meat intake				
Often	11	15	0.18	NS
Not often	46	52		
Bean product intake				
Often	9	23	3.38	NS
Not often	47	54		
Blood type				
A	11	21	2.63	NS
B	13	12		
O	26	26		
AB	1	2		

NS: Not significant

*Education: Low, primary school and lower; High, junior high school and above