

EPIDEMIOLOGICAL SURVEY OF HYPERURICEMIA IN URBAN CHINESE

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In order to gain a better understanding of the prevalence of hyperuricemia in Urban Chinese people as well as to examine the association of hyperuricemia with sociodemographic factors, we compared the serum levels of uric acid in Shuangyuan and Peitou residents of Taipei City. A random sample of 1383 (592 male and 791 female) residents of the Shuangyuan precinct of southern Taipei City and 1540 (628 male and 912 female) residents of the Peitou precinct of northern Taipei City were included in the 1985 study. The level of serum uric acid was determined by autoanalyzer using an enzymatic method. The results of serum uric acid were 5.82 ± 0.09 mg/dl for males and 4.22 ± 0.05 for female from Shuangyuan, and 6.07 ± 0.07 mg/dl for males and 4.07 ± 0.05 mg/dl for females from Peitou, and 5.95 ± 0.06 for males and 4.48 ± 0.04 for females together. The age-adjusted prevalence of hyperuricemia, defined as a serum uric acid > 7.5 mg/dl for males and serum uric acid > 6.0 mg/dl for females, was 17.8 percent for males and 12.4 for females together; 16.2 (raw 15.9 percent) for male and 11.2 percent (raw 9.5 percent) for female Shuangyuan residents; 19.3 percent (raw 19.6 percent) for male and 17.8 percent (raw 25.0 percent) for female Peitou residents, with a significantly in Peitou females and also the total prevalence, but not in the male subgroup. The mean level of serum uric acid was found to increase with age over 70 for males and over 50 for females in these two areas of Taipei city. Further studies aimed at certain specified groups are needed to further reveal the relationship of sociodemographic factors and hyperuricemia. (Chin J. Public Health (Taipei): 1995; 14(3): 220-227)

Key words: Chinese; epidemiology; gout; hyperuricemia

INTRODUCTION

Why isn't this mentioned in the abstract? This should be explained in relation to hyperuricemia. Gout is a syndrome which results from the crystallization of monosodium urate from hyperuricemic body fluids, and gives rise to inflammatory arthritis, tenosynovitis, bursi-

tis, tophi, splanchnic disease and urinary calculi. The disease has also been linked to the development of coronary heart disease, but the precise mechanism is still unknown. Although there have been studies on primary gout in Taiwan [1,2], the epidemiology of hyperuricemia has never been examined among Chinese there. The specific aims of this study include the comparison of the prevalence of hyperu-

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ricemia between residents in Shuangyuan and Peitou Taipei City as well as the examination of sociodemographic characteristics associated with the prevalence of hyperuricemia in urban Chinese.

MATERIALS AND METHODS

The subjects of this study were randomly selected from the Shuangyuan and Peitou precincts of Taipei City. The former is located in southern Taipei City and the later in northern Taipei City. Stratified random sampling was used to select the sample of households, in which all family members were invited to be surveyed in this 1985 study. Among 1399 selected subjects in Shuangyuan and 1585 in Peitou, 1383 and 1540, respectively, participated.

A total of 10 ml fasting blood sample was collected from each study subject in the early morning. Collected samples were centrifuged and kept at -20°C until laboratory examination. Serum samples were tested for uric acid concentration, at the Clinical Biochemical Laboratory of the Taipei Heping Municipal Hospital. The level of serum uric acid was determined by an enzymatic method using uricase and peroxidase (Acide urique enzymatique PAP 800, BioMerieux, France). All the serum chemistry tests were run by autoanalyzer (Centrifichem 500). A detailed and standardized interview based on a structured questionnaire was also carried out to obtain information on sociodemographic characteristics, family history of gout and cardiovascular diseases, as well as risk factors associated with hyperuricemia. All interviews were done by well-experienced public health nurses who had been working in the study area for several years.

The mean level of serum uric acid and standard error were first calculated with respect to age, sex and residency. Analysis of variance was used to test for the significance of the difference in serum uric acid levels among the different groups. Both the independent and interactive effects were assessed. The age-adjusted prevalence using the world population [5] as the standard population was cal-

culated for the comparison between groups. The prevalence of hyperuricemia of both sexes was compared with respect to different educational and occupational levels of Taipei residents. The significance of the difference in age-adjusted prevalence was tested by the Mantel-Haenszel chi-square test [6].

RESULTS

The sociodemographic characteristics of 2923 randomly selected subjects recruited from Shuangyuan and Peitou precincts in Taipei are shown in Table 1. The age distribution was slightly different in the two precincts. Compared with Peitou, Shuangyuan showed a higher proportion of subjects less than 20 years of age, and a lower proportion in subjects over 60. While more females than males participated in this study, the sex distribution was similar in Shuangyuan and Peitou. Around 80 percent of the study subjects were Fukkien Taiwanese in both areas. There was no difference in the educational level of subjects in Peitou and Shuangyuan, and more than half of the study subjects are blue collar workers. Two-thirds of the subjects were married.

Table 2 shows the mean levels of serum uric acid with standard error. For males it was 5.82 ± 0.09 mg/dl in Shuangyuan, 6.07 ± 0.07 mg/dl in Peitou, and 5.95 ± 0.06 overall. For females, it was 4.22 ± 0.05 mg/dl in Shuangyuan, 4.70 ± 0.05 mg/dl in Peitou, and 4.48 ± 0.04 overall. In both areas, there was a significant difference in serum uric acid between males and females ($p < 0.001$). Although females of all age groups in Shuangyuan had a lower serum uric acid level than those in Peitou, the overall difference in serum uric acid level between the two areas was not statistically significant.

The prevalence of hyperuricemia by age, sex and residency is shown in Table 3. The total prevalence of hyperuricemia is 14.7 percent overall, 12.2 percent in the Shuangyuan area and 16.9 percent in the Peitou area with a significant difference between these two areas. The raw prevalence of hyperuricemia is 15.9 percent for males and 9.5 percent for females in the Shuangyuan area; and 19.6 per-

Table 1. Sociodemographic characteristics of 2923 randomly selected study subjects in two areas of Taipei City.

Sociodemographic Characteristics	Groups	Shuangyuan		Peitou		Overall	
		No.	(%)	No.	(%)	No.	(%)
Age	<10	78	(5.6)	59	(3.8)	137	(4.7)
	10-19	180	(13.0)	95	(6.2)	275	(9.4)
	20-29	224	(16.2)	191	(12.4)	415	(14.2)
	30-39	265	(19.2)	354	(23.0)	619	(21.2)
	40-49	241	(17.4)	237	(15.4)	478	(16.4)
	50-59	219	(15.8)	285	(18.5)	504	(17.2)
	60-69	115	(8.3)	239	(15.5)	354	(12.1)
	>70	61	(4.4)	80	(5.2)	141	(4.8)
Sex	Male	592	(42.8)	628	(40.8)	1220	(41.7)
	Female	791	(57.2)	912	(59.2)	1703	(58.3)
Ancestry	Fukkiense	1122	(81.1)	1220	(79.2)	2342	(80.1)
	Other*	261	(18.9)	320	(20.8)	581	(19.9)
Educational level	None	239	(17.3)	304	(19.8)	543	(18.5)
	Elementary	480	(34.7)	584	(37.9)	1064	(36.4)
	Junior high	231	(16.7)	192	(12.5)	423	(14.5)
	Senior high	270	(19.5)	264	(17.1)	534	(18.3)
	college and above	163	(11.8)	196	(12.7)	359	(12.3)
Occupation	White collar	148	(10.7)	233	(15.1)	381	(13.0)
	Blue collar	698	(50.5)	1017	(66.0)	1715	(58.7)
	Else**	537	(38.8)	290	(18.8)	827	(28.3)
Marital status	Married	914	(66.1)	1166	(75.7)	2080	(71.2)
	Single	469	(33.9)	374	(24.3)	843	(28.8)

* Other includes Mainland Chinese, Hakka and aborigines.

** Other includes school children, housewives, retired persons.

cent for males and 15.0 percent for females in the Peitou area; and 17.8 percent for males and 12.4 percent for females overall. The difference is significant in females and total residents participating, but not in males. The age-adjusted prevalence of hyperuricemia was 16.2 percent for male and 11.2 percent for female residents in Shuangyuan as well as 19.3 percent for male and 17.6 percent for female residents in Peitou. The prevalence of hyperuricemia peaked above the age of 70 in males and

above 50 in females. Males had a higher prevalence than females in most age groups in both Shuangyuan and Peitou. Both males and females in the Peitou area had a higher prevalence of hyperuricemia in most age groups than those in the Shuangyuan area.

Table 4 shows the prevalence of hyperuricemia in male and female residents of the two areas according to educational level. The hyperuricemia rates for males of different educational levels were as follows! no education:

Table 2. Mean level of serum uric acid with standard error among 2923 study subjects by sex, age and residency in two areas of Taipei City.

Sex	Age	Shuangyuan			Peitou			Overall		
		No.	Mean	S.E.	No.	Mean	S.E.	No.	Mean	S.E.
Male	<10	43	6.23	0.19	36	5.04	0.24	79	5.69	0.21
	10-19	98	5.45	0.15	32	6.00	0.26	130	5.59	0.19
	20-29	74	5.71	0.16	47	6.36	0.17	121	5.96	0.16
	30-39	112	5.99	0.15	131	6.04	0.15	243	6.02	0.12
	40-49	94	6.00	0.20	87	6.23	0.18	181	6.11	0.18
	50-59	101	6.12	0.16	116	6.11	0.16	217	6.11	0.14
	60-69	45	5.98	0.28	135	6.02	0.15	180	6.01	0.19
	>70	25	7.64	1.10	44	6.47	0.29	69	6.89	0.43
subtotal		592	5.82	0.09	628	6.07	0.07	1220	5.95	0.06
Female	<10	35	3.97	0.23	23	4.81	0.32	58	4.30	0.27
	10-19	82	4.18	0.13	63	4.89	0.19	145	4.49	0.17
	20-29	150	4.04	0.10	144	4.41	0.11	294	4.22	0.09
	30-39	153	3.99	0.09	223	4.53	0.08	376	4.31	0.08
	40-49	147	4.00	0.10	150	4.42	0.10	297	4.21	0.09
	50-59	118	4.55	0.14	169	4.92	0.11	287	4.77	0.12
	60-69	70	4.76	0.20	104	4.99	0.14	174	4.90	0.18
	>70	36	5.07	0.31	36	5.41	0.30	72	5.24	0.25
subtotal		791	4.22	0.05	912	4.70	0.05	1703	4.48	0.04
Total		1383			1540			2923		

Based on the test for the significance of the difference in mean level of serum uric acid: $P < 0.001$ between males and females

12.1%, elementary: 13.8%, junior high: 29.3%, senior high: 15.7%, college and above: 24.2%; for females, no education: 19.0%, elementary: 8.9%, junior high: 13.5%, senior high: 12.1%, college and above: 10.8%. It was significantly different in both males ($X^2=30.11$, $p < 0.01$) and females ($X^2=21.7$, $p < 0.01$) for different levels of education. When considering different the occupational levels of these two areas, there was a significant difference in female residents ($X^2=8.27$, $p < 0.05$), but not in male ($X^2=1.57$, $p > 0.05$). The hyperuricemia rates for males of different occupations were unemployed: 19.5%, blue collar: 18.3%, white collar: 15.8%; for females, unemployed: 19.8%, blue collar: 11.8%, white collar: 11.2% (see Table 5).

DISCUSSION

The prevalence of gout and hyperuricemia with a mean serum uric acid level as high as 7.5 mg/dl or more in males and 6.0 mg/dl or more in females [7-9] varies from country to country as well as from population to population. Gout has been recognized as uncommon among blacks in Africa [3], but rather common among Polynesians [9]. The mean serum uric acid level was 4.9 mg/dl among males and 4.2 mg/dl among females in Tecumseh [10], as well as 5.1 mg/dl and 4.0 mg/dl for males and females, respectively, in Framingham [11]. In this study, we observed a mean level of 5.8 mg/dl for males and 4.2-4.7 for females in

Table 3. Prevalence of hyperuricemia among 2923 study subjects by sex, age and residency in two areas of Taipei City.

Sex	Age	Shuangyuan			Peitou			Overall		
		Total No.	Positive No.	Rate (%)	Total No.	Positive No.	Rate (%)	Total No.	Positive No.	Rate (%)
Male	<10	43	1	(2.3)	36	1	(2.8)	79	2	(2.5)
	10-19	98	13	(13.3)	32	7	(21.9)	130	20	(15.4)
	20-29	74	8	(10.8)	47	8	(17.0)	121	16	(13.2)
	30-39	112	15	(13.4)	131	26	(19.8)	243	41	(16.9)
	40-49	94	20	(21.3)	87	17	(19.5)	181	37	(20.4)
	50-59	101	21	(20.8)	116	26	(22.4)	217	47	(21.7)
	60-69	45	9	(20.0)	135	23	(17.0)	180	32	(17.8)
	>70	25	7	(28.0)	44	15	(34.1)	69	22	(31.9)
subtotal		592	94	(15.9)*	628	123	(19.6)*	1220	217	(17.8)
	age-adjusted			(16.2)			(19.3)			
Female	<10	35	3	(8.6)	23	5	(21.7)	58	8	(13.8)
	10-19	82	7	(8.5)	63	9	(14.3)	145	16	(11.0)
	20-29	150	11	(7.3)	144	17	(11.8)	294	28	(9.5)
	30-39	153	7	(4.6)	223	23	(10.3)	376	30	(8.0)
	40-49	147	9	(6.1)	150	11	(7.3)	297	20	(6.7)
	50-59	118	18	(15.3)	169	33	(19.5)	287	51	(17.8)
	60-69	70	12	(17.1)	104	28	(26.9)	174	40	(23.0)
	>70	36	8	(22.2)	36	11	(30.6)	72	19	(26.4)
subtotal		791	75	(9.5)**	912	137	(15.0)**	1703	212	(12.4)
	age-adjusted			(11.2)			(17.8)			
Total		1383	169	(12.2)***	1540	260	(16.9)***	2923	429	(14.7)

Note: 1. Hyperuricemia defined as a level of serum uric acid greater than 7.5 mg/dl for males and 6.0 for females.

2. Based on chi-square test

* $P > 0.05$, $X^2 = 2.8046$

** $P < 0.005$, $X^2 = 15.9736$

*** $P < 0.005$, $X^2 = 12.6434$

Taipei. It was significantly higher than that among Caucasians in the USA, but lower than that among Polynesians. Although genetic factors may play an important role in the determination of serum uric acid levels, environmental factors including life-style and dietary habits may also contribute to the differences in serum uric acid between Chinese in Taipei and other populations.

There was a significant difference in the

serum uric acid level and the prevalence of hyperuricemia between males and females in Taipei. The results were consistent with those reported previously in other populations. Age was also found to be a major determinant of hyperuricemia as was observed in other populations. Our results showed a remarkably high rate of hyperuricemia for the over 70 age group in males and over 50 in female residents of Taipei. Degenerative changes with aging might

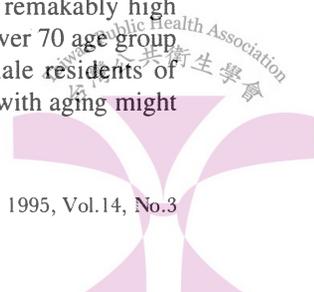


Table 4. Comparison of the prevalence of hyperuricemia in male and female residents of two areas of Taipei with respect to educational level

Education	Male*			Female**		
	Hyperuricemia n [#]	Abnormal rate (%)	Subtotal n (%)	Hyperuricemia n	Abnormal rate (%)	Subtotal n (%)
None	23	(12.1)	190 (15.6)	67	(19.0)	353 (20.7)
Elementary	59	(13.8)	426 (34.9)	57	(8.9)	638 (37.5)
Junior high	48	(29.3)	164 (13.4)	35	(13.5)	259 (15.2)
Senior high	36	(15.7)	229 (18.8)	37	(12.1)	305 (17.9)
College and above	51	(24.2)	211 (17.3)	16	(10.8)	148 (8.7)
Total	217	(17.8)	1220 (100.0)	212	(12.4)	1703 (100.0)

* $X^2=30.11$, $p<0.01$ ** $X^2=21.7$, $p<0.01$

#n: number of cases

Table 5. Comparison of the prevalence of hyperuricemia in male and female residents of two areas of Taipei with respect to occupational level

Occupation	Male*			Female**		
	Hyperuricemia n [#]	Abnormal rate (%)	Subtotal n (%)	Hyperuricemia n	Abnormal rate (%)	Subtotal n (%)
None	47	(19.5)	241 (19.8)	37	(19.8)	197 (11.6)
Blue collar	113	(18.3)	618 (50.7)	129	(11.8)	1097 (64.4)
White collar	57	(15.8)	361 (29.5)	46	(11.2)	409 (24.0)
Total	217	(17.8)	1220 (100.0)	212	(12.4)	1703 (100.0)

* $X^2=1.57$, $p>0.05$ ** $X^2=8.27$, $p<0.05$

#n: number of cases

explain the increase in serum uric acid in the elderly. The reason for the earlier rise in the prevalence of hyperuricemia in females residents is unknown. The exact mechanism deserves further investigation.

The hyperuricemia rates between different educational levels were significantly different for both males and females in Taipei. Interestingly, it was the higher education level, the higher the hyperuricemia rate in male residents. On the contrary, it was highest in fe-

males who had no formal education at all. The hyperuricemia rates were about the same for the other educational levels of females. There was significant differences in female but not in male residents for different occupational levels. The highest hyperuricemia rate in females was those that had no occupation. It was about the same in male residents of all occupational levels. The reason for these phenomena is not clear. Multifactorial analysis including economic status of the family, dietary habits,

smoking, alcohol, etc might be needed in defining the influence of these factors on hyperuricemia. Although this study did include certain life style factors such as smoking, alcohol, and dietary habits, we could not draw any conclusions due to insufficient case numbers. Further study designed for certain groups is mandatory to explore the relationship between serum uric acid levels and these social factors.

REFERENCES

1. Sheffield FJ. Rheumatoid arthritis and gout: A study on Taiwan. *J Formosan Med Assoc* 1963; **62**: 373-78.
2. Kuo TP. Gout in the tropical Taiwan. *J Formosan Med Assoc* 1964; **63**: 415-426.
3. Mody GM, Naidoo PD. Gout in South Africa blacks. *Ann Rheum Dis* 1984; **43**: 394-97.
4. O'Brien WM, Burch TA, Bunim JJ. Genetics of hyperuricemia in Blackfeet and Pima Indians. *Ann Rheum Dis* 1966; **25**: 117-19.
5. Waterhouse J, Muir C, Correa P, Powell J (eds.) *Cancer Incidence in Five Continents, Vol III.* (IARC Scientific Publications No.15). Lyon: International Agency for on Cancer.
6. Mantel N. Chi-square tests with one degree of freedom: Extensions of the Mantel-Haenszel procedure. *J Am Statis Assoc* 1963; **58**: 690-700.
7. Rose BS. Gout in Maoris. *Semin Arthritis Rheum* 1975; **5**: 121-45.
8. Prior IAM, Rose BS. Uric acid, gout and public health in the Pacific. *N Z Med J* 1966; **65**: 295-300.
9. Prior IAM, Rose BS, Harvey HPB, et al. Hyperuricemia, gout, and diabetic abnormality in Polynesian people. *Lancet* 1966; **1**: 333-8.
10. Mikkelsen WM, Dodge HJ, Valkenburg H. The distribution of serum uric acid values in a population unselected as to gout or hyperuricemia: Tecumseh, Michigan, 1959-1960. *Am J Med* 1965; **39**: 242-47.
11. Hall AP, Barry PE, Dawber TR, et al. Epidemiology of gout and hyperuricemia: A long-term population study. *Am J Med* 1967; **42**: 27-31.

高尿酸血症在台北市雙園與北投地區之 流行病學之調查

黃政典

為了要瞭解台灣地區都市居民高尿酸血症的情形，吾人於台北市雙園區與北投區隨機調查其居民，抽血檢查其血清尿酸值之分佈情形。本研究發現：雙園區共1383名，其中男為592名、女為791名血清尿酸平均值：男為 5.82 ± 0.09 mg/dl、女為 4.22 ± 0.05 mg/dl。其中高尿酸血症，男佔16.2%、女佔11.2%。北投區共1540名，其中男為628名、女為912名。血清尿酸平均值：男為 6.07 ± 0.07 mg/dl、女為 4.70 ± 0.05 mg/dl。其中高尿酸血症，男佔19.3%、女佔17.8%。兩區之間，女性居民血清尿酸值有明顯差異、

男性則無。男女兩性，年齡超過70歲組，血清尿酸值都高於其它年齡組別。北投區居民中，男性教育程度在國中及大專以上的高尿酸血症罹患率較高。女性則以無教育者較高。依職業來分，男性並無高尿酸血症罹患率之差異，女性則有明顯差異，以無職業者最高。造成此男女間之差異，其原因尚不清楚，因此建議更進一步對特定族群血清尿酸檢測，以確立不同職業及教育程度與高尿酸血症之關係。(中華衛誌 1995；14(3)：220-227)

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