Original Article

Trends in hyperuricemia and gout prevalence: Nutrition and Health Survey in Taiwan from 1993-1996 to 2005-2008

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Hyperuricemia is a recognized risk factor for cardiovascular disease. This study investigated trends in uric acid levels, hyperuricemia and gout among adults in Taiwan from 1993-1996 to 2005-2008, using data collection from, Nutrition and health surveys in Taiwan (NAHSIT) conducted in 1993-1996 and 2005-2008. Information on food frequency, medical history, physical measures and fasting blood parameters were analyzed. Mean uric acid levels decreased between 1993-1996 and 2005-2008 in both genders (6.77 vs 6.59 mg/dL in men and 5.33 vs 4.97 mg/dL in women) and the prevalence of hyperuricemia declined from 25.3% to 22.0% in men (p<0.0001) and from 16.7% to 9.7% in women (p<0.0001). However, the prevalence of gout (self-reported) increased (4.74% vs 8.21% in men and 2.19% vs 2.33% in women, p<0.0001). Reduced rank regression was used to identify dietary patterns that explained significant amounts of variance in uric acid. Frequency of consumption of lean meat, soy products and soymilk, milk, eggs, vegetables, carrots, mushrooms, fruit and coffee were negatively associated with hyperuricemia, whereas consumption of organ meats, bamboo shoots, and soft drinks were positively associated with hyperuricemia. The dietary factor score (DFS) composed of the frequency of above food items decreased from -5.40 to -6.00 between the two surveys (p<0.0001). In conclusion, uric acid levels and prevalence of hyperuricemia both declined, whilst self-reported gout increased between 1993-1996 and 2005-2008. Changes in dietary patterns may in part explain the decrease in uric acid levels between the two national surveys.

Key Words: uric acid, dietary patterns, trend, national survey, reduced rank regression

INTRODUCTION

Cardiovascular disease is a major public health issue in Taiwan and is responsible for 27% of deaths. Hyperuricemia is a recognized independent risk factor for cardiovascular disease,[1,2] and the association between high uric acid and CVD exists even in a low CVD risk population. Taiwan is a region with a relatively high rate of hyperuricemia, with a prevalence of 43.7% in men and 27.4% in women aged ≥15 years.[3] This high prevalence suggests that hyperuricemia may make a substantial contribution to cardiovascular disease risk in Taiwan.

Dietary behavior is changing in Taiwan, partly as a result of improved nutritional knowledge and behavior. Previous studies have reported that uric acid levels can be affected by diet.[4,5] Ingestion of seafood increases uric acid,[4] whereas milk consumption reduces the risk of hyperuricemia.[5] Although studies have reported associations between the ingestion of single foods and hyperuricemia, dietary patterns usually reflect combinations of multiple foodstuffs. Therefore, it is more appropriate to use dietary patterns (multiple foods) when investigating the association between dietary intake and hyperuricemia. Reduce rank regression (RRR) is a multivariate method that has been recently used to investigate associations between particular dietary patterns and disease traits or biomarkers.[6] Compared to investigations focused on single food items, examination of dietary patterns is more likely to comprehensively represent the actual components of a person's diet. As a result, we decided to investigate trends in uric acid levels and the prevalence of hyperuricemia between two national surveys, and to identify dietary patterns associated with high and low uric acid levels using RRR.

MATERIALS AND METHODS

Study population

The two Nutrition and Health Surveys in Taiwan (NAHSIT) were carried out during 1993-1996[3] and 2005-2008.[7] The samples in the two surveys were both selected using a stratified multi-stage sampling method. The response rate was 74% in NAHSIT 1993-96, and 65% in NAHSIT

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2005-2008. The survey methods have been described in detail previously.[3,7] There were 2979 adults (1395 men and 1584 women) from NAHSIT 1993-96 and 1661 adults (809 men and 852 women) from NAHSIT 2005-08 with complete questionnaire and uric acid data that were used for this analysis.

Measures

Food frequency questionnaire

Data on the frequency of food intake was collected by well-trained interviewers and the same 28-item food frequency questionnaire was used in both national surveys.[8] Food items measured in the questionnaire included: fish, poultry (chicken and duck), lean meat (pork), high-fat meat, soy products (tofu), soy milk, milk, eggs, vegetables, fresh fruit, pickled vegetables, fermented foods, deep fish, shellfish, other seafood (shrimp and crab), seaweed, liver, other organ meats, carrots, melons, mushrooms, bamboo shoots, beans, dark colored vegetables, soft drinks, juice, and coffee. For all items the frequency of intake per week was measured.

Definition of hyperuricemia and gout

Hyperuricemia was defined as a serum uric acid concentration of more than 7.7 mg/dL (458 μM) in men and more than 6.6 mg/dL (393 μM) in women, or use of uric acid lowering drugs. The presence of gout was determined by self-report answer to the question "Has a doctor ever told you that you have gout?"

Statistical analysis

The distribution of uric acid concentrations in the two surveys were described by means and standard errors. Student's *t* test and chi-square test were used to compare uric acid levels and the prevalence of hyperuricemia, respectively, between the two surveys. Due to the complex sampling design, SUDAAN was used to weight the two survey samples before calculating estimates.[7]

We used RRR to identify dietary patterns associated with uric acid levels. RRR extracts factors (food frequency), aiming to explain the maximum possible variation of uric acid concentration. RRR is an appropriate statistical method that can be used to identify dietary patterns associated with disease traits or biomarkers,[6] and has been used to determine the dietary patterns associated with incidence of type 2 diabetes mellitus.[9-11] The absolute factor loading for the dietary pattern score was set at more than 0.2 in both men and women.[9] The dietary pattern score was generated by the following equation:

Dietary pattern score = factor loading × frequency of food intake (times/week)

Participants were classified into four groups based on quartiles of dietary patterns. Logistic regression was used to estimate the odds ratio of hyperuricemia for the second to fourth quartiles of dietary pattern score, compared to the lowest quartile. We also tested for a trend in the relationship between dietary pattern and hyperuricemia, using the median value of the dietary pattern score for the four groups and logistic regression.

RESULTS

Uric acid levels by gender and age

The distribution of serum uric acid levels by age and gender in the two surveys are described in Table 1. In the most recent survey (NAHSIT 2005-2008), men had higher levels (6.77 vs. 5.33, p<0.001) and a higher prevalence of hyperuricemia than women (Table 1). Uric acid concentrations in adults aged 19-45 yrs, 45-64 yrs and ≥65 years were 6.73, 6.33, and 6.59, respectively in men (p for trend = 0.020), and 4.65, 5.11, and 5.98, respectively in women (p for trend <0.0001). Similarly the prevalence of hyperuricemia in the same age groups was 22.1%, 18.8% and 25.8%, respectively in men (p for trend <0.0001) and 4.3%, 9.1%, and 33.6%, respectively in women (p for trend <0.0001). Residents in mountainous areas and the Penghu islands had a higher prevalence of hyperuricemia and gout. (Table 2)

Trends in uric acid levels and prevalence of hyperuricemia and gout

A decreasing trend was observed from NAHSIT 1993-1996 to NAHSIT 2005-2008 in uric acid levels (6.77→6.59 mg/dL in men, p<0.0001; 5.33→4.97 mg/dL in women, p<0.0001) and in the prevalence of hyperuricemia (25.3%→21.6% in men, p<0.0001; 16.7%→9.6% in women, p<0.0001). However, the prevalence of gout increased between the two surveys (4.74%→8.21% in men; 2.19%→2.33% in women). (Table 3)

Dietary patterns associated with uric acid levels

Table 4 shows factor loadings for dietary pattern scores associated with uric acid levels in men and women. Food items with a factor loading of at least -0.2 or 0.2 were selected as part of the dietary pattern associated with high

Table 1. Uric acid concentration, hyperuricemia and gout by age and gender in NAHSIT 2005-2008

	Gender	19 - 44.9 yrs	45 - 64.9 yrs	≥ 65
Uric acid (mg/dL)	Men	6.73 (6.56 – 6.91)	6.33 (6.16– 6.51) †	6.59 (6.40 - 6.77) †
	Women	4.65 (4.53 – 4.78)	5.10 (4.98 - 5.24) †	5.98 (5.77- 6.18) †
		p<0.0001	p< 0.0001	p<0.0001
Hyperuricemia‡ (%)	Men	22.1 (22.1 – 22.2)	18.8 (18.8 - 18.9) †	25.8 (25.7 - 25.9) †
	Women	4.26 (4.24 - 4.28)	9.13 (9.09 - 9.16) †	33.6 (33.5-33.7) †
		p-value < 0.0001	p<0.0001	p< 0.0001
Gout (%)	Men	7.20 (7.18-7.22)	8.86 (8.82-8.89) †	10.9 (10.9-11.0) †
	Women	1.02 (1.01-1.02)	2.28 (2.26-2.30) †	8.12 (8.06-8.17) †
		p<0.0001	p<0.0001	p<0.0001

†Compared to participants aged 19-49 years, p-value<0.05
‡Uric acid ≥7.7 mg/dL in men and ≥ 6.6 mg/dL in women or using uric acid lowering drugs.
Parentheses indicate 95% confidence intervals.

Table 2. Uric acid concentration, hyperuricemia and gout by geographical area and gender in NAHSIT 2005-2008

	Gender	Northern I	Northern II	Middle	Southern	Eastern	Hakka areas	Mountainous areas	Peng-hu Islands
Uric acid (mg/dL)	Men	6.50† (6.26-6.73)	6.51† (6.33-6.70)	6.65† (6.44-6.85)	6.70† (6.48-6.93)	6.33† (6.09-6.57)	6.53† (6.30-6.75)	8.04 (7.73-8.35)	7.11 (6.86-7.37)
	Women	4.77† (4.59-4.95)	4.89† (4.71-5.07)	5.05† (4.86-5.24)	5.16† (4.96-5.36)	4.98† (4.77-5.19)	5.09† (4.89-5.29)	6.05 (5.77-6.33)	5.13 (4.92-5.35)
Hyperuricemia (%)	Men	23.8† (23.8-23.9)	18.4† (18.2-18.4)	20.6† (20.5-20.6)	21.6† (21.5-21.6)	21.1† (20.9-21.2)	20.2† (20.1-20.3)	53.2 (52.8-53.5)	36.6† (36.1-37.1)
	Women	6.66† (6.63-6.69)	9.42† (9.37-9.47)	12.5† (12.4-12.5)	10.4† (10.4-10.5)	9.71† (9.58-9.85)	12.2† (12.1-12.2)	34.8 (34.4-35.2)	17.9† (17.4-18.3)
Gout (%)	Men	13.4† (13.4-13. 5)	8.36† (8.31-8.41)	6.73† (6.69-6.76)	4.14† (4.11-4.16)	7.31† (7.20-7.41)	9.55† (9.49-9.61)	30.8 (30.5-31.1)	15.9† (15.5-16.3)
	Women	1.42† (1.40-1.43)	1.43† (1.41-1.45)	3.57† (3.55-3.60)	2.76† (2.74-2.78)	1.70† (1.65-1.76)	2.66† (2.63-2.70)	4.80 (4.64-4.97)	4.83† (4.60-5.06)

†Age adjusted and compared to mountainous areas, *p*-value <0.05.

Table 3. Uric acid, hyperuricemia and gout in NAHSIT 1993-1996 and 2005-2008

	Gender	1993-1996	2005-2008	*p*-value†
Uric acid (mg/dL)	Men	6.77 (6.69-6.85)	6.59 (6.49-6.69)	< 0.001
	Women	5.33 (5.26-5.40)	4.97 (4.88-5.06)	< 0.001
		p<0.001	*p*<0.001	
Hyperuricemia (%)	Men	25.3 (25.3-25.3)	21.6 (21.5-21.6)	< 0.001
	Women	16.7 (16.7-16.7)	9.57 (9.55-9.59)	< 0.001
		p<0.001	*p*<0.001	
Gout (%)	Men	4.74 (4.72-4.75)	8.21 (8.19-8.23)	< 0.001
	Women	2.19 (2.17-2.20)	2.33 (2.32-2.34)	< 0.001
		p<0.001	*p*<0.001	

†Adjusted for age

Table 4. Factor loadings for the dietary items associated with uric acid concentration

Food item	Men	Women
	Factor loading	Factor loading
Lean meat	-0.240†	-0.176
Soy products	-0.313†	-0.290†
Eggs	-0.135	-0.329†
Vegetables	-0.202†	0.064
Fermented foods	0.296†	-0.047
Other seafood	-0.220†	-0.240†
Seaweed	-0.064	-0.398†
Organ meats	0.218†	-0.006
Carrots	-0.332†	-0.241†
Mushrooms	-0.189	-0.309†
Bamboo shoots	0.232†	0.208†
Dark vegetables	0.073	-0.248†
Soft drink	0.335†	0.074
Coffee	-0.378†	-0.294†

†absolute factor loading ≥0.2

uric acid levels.

In men, foods that provided factor loadings above the cut-off (≤-0.2 or ≥0.2) from highest to lowest were: coffee (-0.378), carrots (-0.332), soy products (-0.313), lean meat (-0.240), seafood/other than fish (-0.220), vegetables (-0.202), mushrooms (-0.189), eggs (-0.135), organ meats (0.218), bamboo shoots (0.232), fermented foods (0.296), and soft drinks (0.335).

In women, foods that provided factor loadings above the cut-off (≤-0.2 or ≥0.2) from highest to lowest were: seaweed (-0.398), eggs (-0.329), mushrooms (-0.309), coffee (-0.294), soy products (-0.290), dark colored vegetables (-0.248), carrots (-0.241), other seafood (-0.240), and bamboo shoots (0.208).

Table 5 shows the weighted means of food intake frequency by the four quartiles of uric acid level. There was a linear association between uric acid concentration and intake frequency of soy products, fermented foods, organ meats, carrots, mushrooms, soft drinks and coffee in men, and intake of soy products, eggs, seaweed, carrots, mushrooms, bamboo shoots, soft drinks and coffee in women.

Uric acid levels increased as the dietary pattern scores increased. In men, mean uric acid concentrations were 6.45, 6.61, 6.86, and 7.08 mg/dL, respectively in the 1st, 2nd, 3rd and 4th quartiles of dietary pattern score (p for trend <0.0001). A similar result was also noted in women (uric acid levels of 5.19, 5.27, 5.41, and 5.73 mg/dL, respectively for each quartile; p for trend <0.0001). After adjusting for age, sex and alcohol consumption, the odds ratio for hyperuricemia was 1.18 (95% confidence interval =0.91-1.52) for the 2nd quartile of dietary score, 1.50 (1.18-1.91) for the 3rd quartile and 1.92 (1.53-2.42) for 4th quartile of dietary pattern score, compared to the reference group (1st quartile). We also found that the dietary pattern score decreased from -5.40 (NAHSIT 1993-1996) to -6.0 (NAHSIT 2005-2008) between the two surveys (p<0.0001). This difference remained statistically significant even after controlling for body mass index and alcohol consumption.

DISCUSSION

Significant decreasing trends in both uric acid levels and the prevalence of hyperuricemia were observed between NAHSIT 1993-1996 and NAHSIT 2005-2008. However, the prevalence of gout increased over the same period. The dietary pattern associated with lower uric acid levels included frequent intake of vegetables, eggs, lean meat, soy products, seaweed, and coffee, and less intake of bamboo shoots, organ meats and soft drinks. The decline in uric acid levels between the two surveys may be in part explained by changes in dietary patterns over the same period.

The NAHSIT 1993-1996 revealed that residents in mountainous areas and the Penghu islands had a higher prevalence of hyperuricemia,[3] and a similar finding was observed in the most recent survey (2005-2008). Taiwanese indigenous people are more likely to live in mountainous areas and therefore the higher prevalence of hyperuricemia in this region could be influenced either by genetic or environmental factors in this population. A previous study has found that genetic variation may partly explain the high prevalence of hyperuricemia among Taiwanese aborigines.[12] Indigenous people in Taiwan also have a higher prevalence of alcohol consumption and the lactic acid generated during alcohol metabolism can suppress renal excretion of uric acid. Residents of the Penghu islands are mostly fishermen and may frequently consume seafood, which could explain the higher uric acid levels observed in this area.

It is well recognized that foods rich in purine, such as organ meats, mushrooms, bamboo shoots and soybean, increase uric acid levels. However, our study revealed a negative association between frequency of soybean intake and uric acid. A previous clinical trial found that intake of tofu did not result in an increased concentration of uric acid,[13] even in gouty patients with uric acid levels of more than 6.0 mg/dL. Moreover, soy protein can be more effective in lowering uric acid than casein.[14] A population based study has also revealed a negative association between milk intake and uric acid.[5] In the present study, seaweed intake was negatively associated and bamboo shoots were positively associated with uric acid levels. To date no studies have reported an association between bamboo shoots and uric acid. However, an intervention study in healthy young women found that bamboo shoots as a dietary fiber source has beneficial effects on lipid profile and bowel function.[15] Bamboo shoots are frequently prepared with high-fat meats or oily foods in Taiwan and this could explain the positive association between intake of bamboo shoots and uric acid. We also found a negative association between mushrooms and uric acid. An animal experiment found that rabbits consuming cholesterol-enriched foodstuffs along with mushrooms had lower levels of uric acid than those who consumed cholesterol-enriched foodstuffs only.[16] Further research is required to establish the efficacy of mushrooms in lowering uric acid.

Uric acid is associated with insulin resistance, the metabolic syndrome, and obesity. Hyperinsulinemia may decrease excretion of serum uric acid and studies have shown that weight loss can be accompanied by a decrease in uric acid levels.[17,18] Soy products may promote weight loss as they are rich in plant-based calcium. A prospective randomized controlled trial showed that soy milk was as effective as skim milk in promoting weight loss.[19]

The association between coffee consumption and uric acid has not been well established. Our study found that coffee consumption was negatively associated with uric acid levels (p<0.05). A cross-sectional study [20] in Japanese men revealed that coffee consumption was inversely associated with uric acid level, but no association was found between green tea consumption and uric acid, which suggests that the lower levels of uric acid associated with coffee intake may not solely due to caffeine. Further, the third National Health and Nutrition Examination Survey [21] showed a modest inverse association between de-caffeinated coffee intake and serum uric acid level (p for trend 0.035) which suggests that other components in coffee may be related to low uric acid levels. It is possible that the xanthines contained in coffee may decrease uric acid levels, as allopurinol is a structural isomer of hypoxanthine that inhibits xanthine oxidase.[22]

The positive association between consumption of soft drinks and uric acid levels in this study is consistent with

Table 5. Weighted mean intake frequencies (per week) of foods by quartile of uric acid concentration in men and women

	Uric acid (Men)				*p* for trend†	Uric acid (Women)				*p* for trend†
	Q1	Q2	Q3	Q4		Q1	Q2	Q3	Q4	
Lean Meat	3.63±0.17	3.72±0.18	3.82±0.21	3.53±0.16	0.664	3.24±0.18	3.25±0.17	3.54±0.18	3.22±0.14	0.465
Soy products	1.68±0.10	1.48±0.10	1.32±0.08	1.30±0.08	0.001	1.54±0.11	1.51±0.09	1.37±0.10	1.21±0.07	0.002
Eggs	3.26±0.13	3.19±0.13	3.05±0.13	3.08±0.11	0.079	3.08±0.14	2.78±0.10	2.79±0.12	2.40±0.09	0.020
Vegetables	15.3±0.34	16.0±0.32	15.5±0.35	15.2±0.28	0.584	14.9±0.34	16.2±0.29	15.8±0.31	15.8±0.26	0.281
Fermented foods	0.57±0.06	0.49±0.05	0.78±0.11	0.73±0.07	0.012	0.68±0.09	0.51±0.06	0.50±0.06	0.60±0.05	0.295
Other seafood	0.58±0.05	0.60±0.05	0.65±0.06	0.55±0.03	0.386	0.57±0.05	0.57±0.06	0.47±0.05	0.44±0.03	0.409
Seaweed	0.70±0.04	0.64±0.04	0.75±0.06	0.66±0.06	0.632	0.79±0.06	0.67±0.05	0.62±0.05	0.48±0.03	0.001
Organ meats	0.19±0.02	0.22±0.02	0.23±0.03	0.31±0.05	0.046	0.18±0.02	0.16±0.02	0.20±0.02	0.17±0.02	0.065
Carrots	1.67±0.11	1.51±0.11	1.57±0.11	1.27±0.08	0.004	1.94±0.13	1.83±0.11	1.61±0.12	1.49±0.09	0.009
Mushrooms	1.09±0.08	1.07±0.08	1.00±0.07	0.91±0.06	0.017	1.20±0.09	1.09±0.06	1.03±0.08	0.82±0.06	0.002
Baboon shoots	0.94±0.09	1.19±0.11	1.07±0.08	1.17±0.10	0.202	0.90±0.10	0.91±0.07	0.83±0.07	1.14±0.09	0.007
Dark vegetables	6.59±0.25	6.95±0.26	7.31±0.29	6.70±0.24	0.940	7.52±0.28	7.35±0.25	7.24±0.27	7.10±0.22	0.879
Soft drink	0.69±0.09	0.83±0.10	0.90±0.12	1.12±0.10	0.013	0.39±0.07	0.48±0.06	0.54±0.08	0.44±0.04	0.046
Coffee	0.68±0.09	0.65±0.10	0.54±0.07	0.42±0.05	0.002	0.62±0.09	0.67±0.09	0.61±0.08	0.31±0.04	0.002

†Adjusted for age

other studies.[23,24] The Third National Health and Nutrition Examination Survey found an association between serum uric acid levels and sugar-sweetened soft-drink consumption,[23] independent of other risk factors for hyperuricemia. Soft-drinks contain large amounts of fructose, which increase uric acid levels.[25] Moreover, frequent soft-drink consumption leads to increased levels of glucose and accompanying hyperinsulinemia, leading to suppression of uric acid excretion [26-28] and increased risk of the metabolic syndrome.[29] Therefore, frequent consumption of soft drinks should be considered as a risk factor for hyperuricemia.

Research has demonstrated that animal protein intake can increase uric acid levels and the risk of gout. However, frequent intake of lean meat and seafood was negatively associated with uric acid in our study. It is not clear whether lean meat and seafood stand for less consumption of high fat meat or this unusual observation is due to the cross-sectional design of our study. Individuals with hyperuricemia may have changed their diet to avoid intake of seafood and meat, leading to the unexpected inverse association observed between uric acid and intake of these foods in our study.

Increased gout prevalence

Gout was defined based on self-report disease history. This method could have over-estimated the prevalence of gout as participants might wrongly consider any kind of joint pain as gout. Accumulation of uric acid or high uric acid levels are not the only cause of gout. Alcohol consumption and central obesity are also gout risk factors.[30] Among those with asymptomatic hyperuricemia; increased uric acid level, persistent alcohol consumption, use of diuretics, and increased body mass index are independent predictors of gout.[31] Excessive alcohol consumption, particularly if occasional, is one of the most important risk factors for gout.[31] A Chinese study also found that the metabolic syndrome was associated with attacks of gout.[32] In addition, as the prevalence of the metabolic syndrome has increased between the last two national surveys [33] in Taiwan, the control of central obesity and the metabolic syndrome are important issues for preventing gout attacks in addition to lowering uric acid levels.

Strengths and limitations

The present study has several strengths and limitations. First, the sample was taken from two representative national surveys, allowing the study results to be generalized to the national population. Second, the two national surveys that were used to examine changes in uric acid levels and the prevalence of hyperuricemia used the same diagnostic definitions. Third, RRR was used to identify the dietary pattern associated with uric acid concentration. Moreover, we were able to observe that the dietary pattern score declined between the two surveys, suggesting that the observed decrease in uric acid may be due to changes in dietary patterns. A weakness of this study was that the association between uric acid and dietary pattern was only cross-sectional, and prospective studies are required to examine this relationship further.

CONCLUSION

Uric acid levels and the prevalence of hyperuricemia declined in both men and women between NAHSIT 1993-1996 and NAHSIT 2005-2008. The lowering of uric acid between the two national surveys is possibly in part due to changes in dietary patterns. Further prospective research is needed to examine whether frequent intake of foods associated with uric acid lead to changes in uric acid levels.

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AUTHOR DISCLOSURES

All authors declare no conflicts of interest.

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Original Article

Trends in hyperuricemia and gout prevalence: Nutrition and Health Survey in Taiwan from 1993-1996 to 2005-2008

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高尿酸血症與痛風盛行率的趨勢: 臺灣營養健康家戶調查，1993-1996 至 2005-2008

高尿酸血症已經被認為是心血管疾病的重要危險因子之一。本研究的目的為探討臺灣人民血中尿酸濃度、高尿酸血症與痛風盛行率及相關飲食生活型態因子的變遷狀況。兩次的營養健康家戶調查顯示，近十幾年來臺灣人民血中尿酸濃度有下降的趨勢，男性的平均值從 6.77 mg/dL 下降到 6.59 mg/dL；女性的平均值從 5.33 mg/dL 降到 4.97 mg/dL。高尿酸血症(男性 ≥7.7 mg/dL; 女性 ≥6.6 mg/dL)的盛行率也同樣有下降趨勢，在男性從 25.3%下降到 22.0%；女性則從 16.7%下降到 9.7% (p<0.0001)。但是自述的痛風盛行率反而增加，男性從 4.74% 上昇至 8.21% ，女性從 2.19% 增至 2.33% (p<0.0001)。本研究亦探討血中尿酸濃度的下降與飲食型態改變的關係。以減維度回歸法，發現一飲食型態因子與尿酸濃度有負相關，此飲食型態為食用較多的家畜瘦肉、黃豆製品、蛋類、蔬菜、胡蘿蔔、蕈菇類、水果與咖啡，且食用較少的臟類食物、竹筍與含糖飲料。進一步將此飲食型態轉換為可比較的分數，結果發現在兩次營養健康家戶調查間，此飲食型態分數，從 -5.40 下降到 -6.00 (p<0.0001)。將此飲食型態分數分為四等分；以飲食型態分數最低組為參考組，第二組的高尿酸血症相對風險為 1.18，第三組的相對風險為 1.50，第四組為 1.92。傳統觀念認為黃豆製品與蕈菇類食物可能會導致血中尿酸濃度上升，但本研究顯示，黃豆製品與蕈菇類食物攝取與尿酸濃度呈現負相關，顛覆過去的傳統認知。國人應儘量減少內臟類食物的攝取，增加蔬果(包含胡蘿蔔與蕈菇類)、黃豆製品、海藻類的攝取，以避免尿酸濃度的上昇。

關鍵字: 尿酸、飲食型態、趨勢、臺灣營養健康家戶調查、減維度回歸法