Investigating the Relationship between Point-Of-Care Uric Acid and Dietary Pattern

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Abstract

Introduction High serum uric acid due to improper dietary intake has been identified to associate with painful gouty attack. This study investigates the relationship between point-of-care testing in uric acid and the dietary pattern among participants attending the 2014 Vegetarian Festival in Hong Kong.

Method A cross-sectional study was conducted using questionnaire to collect demographic data and dietary pattern of the participants. Point-of-care analyzer was used to measure their serum uric acid. Data was analyzed by descriptive and non-parametric statistics.

Results A total of 94 health seekers participated in the study. A prevalence of high POC-UAs was identified among these participants (14.9% (14/94)); non-vegetarians (18.5% (12/65)) tended to have a higher proportion of high POC-UAs compared to vegetarians (7.1% (2/28)); half of these participants with high POC-UAs had obesity 23.5% (4/17) and 1-3 chronic diseases (53.3% (8/15)). The POC-UAs of those having 1-3 chronic diseases 53.3% (8/15) were also significantly greater than those of a single chronic disease 25.0% (1/4) (X^2=26.769, p<0.001).

Discussion The findings suggested that Point-of-care testing can be an effective predictor of gout risk as most individuals may be unaware of their hyperuricemia condition because of asymptomatic at an early stage.

Conclusion For a better control of hyperuricemia and prevention of acute gouty attack, health education with a convenient monitoring using Point-of-care method and dietary intervention is recommended.

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Introduction

Nutrition and diets play a major role in the prevention and control of non-communicable diseases (NCDs) such as cardiovascular disease, hypertension, diabetics and gout (1–4). Gout occurs when excessive amount of serum uric acid (SUA) accumulates. This can trigger acute gout pain attack (flares), and impending individual daily activities. Risk factors include family history, age and gender, obesity, diets, certain NCDs and medications (5–7).

In Hong Kong, the prevalence of gout has risen to 2.9% by 2016, which was comparable to the Western countries (8-11).

In 2018, the government launched a "Towards 2025: Strategy and Action Plan to Prevent and Control Non communicable Diseases in Hong Kong" program. This aimed to improve Hong Kong people's general health and early prevention of health risks inducing chronic diseases. Promoting healthy diets was one of the five lifestyle/improvement area identified in public health (3).

Dietary pattern and gout
Evidence indicates that several dietary factors such as alcohol consumption, free fructose, and excessive intake of red meat, organ meat or seafood have been

Research and Best Practice

associated with the risk of gout because of the high purines content (5;6;12–20). Indeed, restricting dietary purine has been the predominant therapeutic approach for gout prevention (6;21;19). Many studies found vegetarian diets associated with lower risk of gout (16;20;22-29). Large cohort studies suggested dairy products to be protective against gout (16;28;30). However, it should also be noted that some vegetarian foods such as yeast extracts contain high amount of purines (150–1000 mg/100 g); while beans, pulses and some vegetable contains moderate amount of purines (50–150 mg/100 g) (31). In contrast, some studies reported no association between purine-rich foods and gout (30;32). This discrepancy suggests that perhaps dietary purine has different physiological effect(s) on individuals' uric acid level, which is the end product of purine metabolism. Our study aims to investigate any relationship between individual's dietary pattern and their SUA level.

Point-of-Care Testing of Serum Uric Acid

The main goal of gout management is to sustain lowering of SUA within the target range (21;33). Point-of-care testing (POCT) is an analysis of patients' specimen such as a blood test outside clinical laboratory, at the time and place of patient care (34). Point-of-care uric acid (POC-UA) used finger-prick method to obtain a small drop of blood and the SUA result analyzed by a portable machine. Such an assessment device provides a convenient, user-friendly, efficient and accurate measurement of SUA to evaluate an individual's baseline and trend. It allows monitoring at times of need and prompt management and care adjustment. Moreover, learnt self-assessment would enhance clients' understanding of their health problems. Self-care ability and management regime compliance could be greatly improved (34;35).

Research Questions

The aim of this study was to investigate any relationship between POC-UA level and the dietary pattern among participants attending the second vegetarian festival (Vegfest) in Hong Kong. The research questions are as follows:

1) What is the incidence of high POC-UA level (male≥0.43 mmol/L, female≥0.37 mmol/L) among the participants, which suggests hyperuricemia of individuals at risk of gout?
2) What are the demographic characteristics and medical history of the participants?
3) Is there a relationship between demographic characteristics and high POC-UA level?
4) What is the dietary pattern among the participants?
5) Is there a relationship between dietary pattern and POC-UA among the participants?

Method

Design and sampling

The study was a cross-sectional design using survey and observational method. It was conducted at the 2nd Vegfest of Hong Kong in 2014. Vegfest was a joint project organised by a collaboration of major organisations and institutions with the aim of promoting vegetarian diets to the community for individual health benefits (36;37). It was estimated that more than 4,000 health seekers attended the event. A convenient sample of 94 participants were recruited to attend a health education session and joined in the study. All participants fulfilled the inclusion criteria of at least 21 years of age, and able to understand and read Chinese and or English.

Ethical consideration

Ethical approval was granted by the Hong Kong Macao Conference of Seventh-day Adventist, Hong Kong Adventist College and Hong Kong Adventist Hospital prior to the study. Nature and procedure of the study was explained to the participants and their questions were addressed. They were then asked to read an information leaflet and sign a consent form before the survey and POC-UA assessment. A health food book was awarded to the participants on completion of the survey procedure.

Instruments

The survey used a structured self-administered questionnaire, which aimed to collect the demographic data and dietary pattern of the participants (1). For dietary pattern, it was classified into two groups: vegetarians and non-vegetarians. Although vegetarians were categorized into four types in general (1;2), but for this study, vegetarians were defined as non-meat eating dietary pattern and non-vegetarians were meat-eating dietary pattern.

POC-UA analyser (BeneCheck Plus 3in1) was used to measure SUA by finger-prick method. According to manufacturer recommendation, normal POC-UA level for male and female lied between 0.19-0.43 mmol/L and 0.14-0.37 mmol/L respectively. High POC-UA level for male and female were ≥0.43 mmol/L and ≥0.37 mmol/L respectively (38).

Statistical methods

Data analysis was performed using SPSS (version 22). Participants' demographic characteristic were descriptive by means of frequency and percentages. Any association between POC-UA level and dietary pattern was analysed using Chi-Square Test.

Research and Best Practice

Table 1. Demographic characteristics and SUA levels.

Characteristics		Normal[a]		High[b]		Total (N=94)	
Gender	Male	75%	(9/12)	25%	(3/12)	13%	(12/94)
	Female	87%	(71/82)	13%	(11/82)	87%	(82/94)
Age*	21-40	75%	(3/4)	25%	(1/4)	4%	(4/94)
	41-60	94%	(58/62)	6%	(4/62)	66%	(62/94)
	> 60	68%	(19/28)	32%	(9/28) *	30%	(28/94)
Education	Primary/ below	76%	(13/17)	24%	(4/17)	18%	(17/93)
	Secondary/ High School	84%	(42/50)	16%	(8/50)	53%	(50/93)
	Tertiary/ above	92%	(24/26)	8%	(2/26)	28%	(26/93)
Religion	Buddhists	85%	(22/26)	15%	(4/26)	28%	(26/94)
	Christians	96%	(26/27)	4%	(1/27)	29%	(27/94)
	Catholics	25%	(3/12)	75%	(9/12)	13%	(12/94)
	Others	100%	(3/3)	0%	(0/3)	3%	(3/94)
	None	77%	(20/26)	23%	(6/26)	28%	(26/94)

Age* X^2=10.078, p=0.006

[a] Normal   Male: 0.19-0.43; Female: 0.14-0.37
[b] High   Male: >0.43; Female: >0.37

Results

Participants' demographic characteristics

A total of 94 health seekers participated in the study. Table 1 presents the demographic characteristics and dietary pattern of the participants. A majority of them was female (87.2% (82/94)), within the age group of 41-60 years (66.0% (62/94)), and non-vegetarians (70.2% (66/94)). About half of the participants (54.2% (51/94)) were secondary school educated. There were 27.7% (26/94) Buddhists, 28.7% (27/94) Christians, 12.8% (12/94) Catholics and 23.1% (26/94) Atheists.

Characteristics of hyperuricemic subjects

For the distribution of those with high POC-UA (15.0% (14/94)) (Table 1), the results showed that more male (25.0% (3/12)) with elevated POC-UA than female (13.4%, 11/82) though not significant. Comparing the age groups, elderly with high POC-UA level ≥61 years old (32.1% (9/28)) were significantly more than the other two age groups adults 25.0% (1/4) and middle-aged 6.5% (4/62), X^2=10.078, p=0.006. There were more primary educated subjects with high POC-UA 23.5 % (4/17) than secondary 16.0% (8/50) and tertiary educated 7.7% (2/26). Relatively more subjects with no religious belief had elevated POC-UA 23.1% (6/26) than those with religious belief 11.8% (8/68). Subjects with obesity 23.5% (4/17) or 1-3 chronic diseases 53.3% (8/15) were also significantly greater than those of a single chronic disease 25.0% (1/4) (X^2=26.769, p=0.000) (Table 2).

Association of POC-UA and dietary pattern

The association of dietary pattern and POC-UA were displayed in Table 3. Non-vegetarians (18.0% (12/65))

Table 2. Chronic Disease Vs POC-UA (mmol/L)

Chronic Disease	Normal		High[a]		Total (N=94)	
Obesity	76%	(13/17)	24%	(4/17)	18%	(17/94)
Cancer	100%	(2/2)	0%	(0/2)	2%	(2/94)
Hypertension	75%	(3/4)	25%	(1/4)	4%	(4/94)
Diabetic	100%	(1/1)	0%	(0/1)	1%	(1/94)
Other	100%	(6/6)	0%	(0/1)	6%	(6/94)
1-3 Chronic Disease	47%	(7/15)	53%	(8/15)	16%	(15/94)*
None	98%	(48/49)	2%	(1/49)	52%	(49/94)
Total:	85%	(80/94)	15%	(14/94)	100%	(94/94)

[a] High   Male: >0.43; Female: >0.37
* X^2=26.769, p<0.001

tended to have higher POC-UA level than vegetarians' (7.1% (2/28)) although no significant difference was found between them (Fisher Exact Test, p=0.215).

Table 3. Dietary Pattern Vs POC-UA (mmol/L)

Dietary Pattern*	Normal[a]		High[b]		Total[c] (N=93)	
Non-vegetarians	82%	(53/65)	18%	(12/65)	70%	(65/93)
Vegetarians	93%	(26/28)	7%	(2/28)	30%	(28/93)
Total:	85%	(79/93)	15%	(14/93)	100%	(93/93)

[a] Normal   Male: 0.19-0.43; Female: 0.14-0.37
[b] High   Male: >0.43; Female: >0.37
[c] 1 missing
* Dietary Pattern Fisher Exact Test, p=0.215

Discussion

Characteristics of subjects

This study aimed to investigate any relationship between POC-UA level and the dietary pattern among participants attending the second "Vegfest" in Hong Kong. The results support the notion that utilization of POC-UA analyser to assess hyperuricemia can facilitate the control of SUA

levels through a choice of appropriate vegetarian diets. The high percentage of hyperuricemic subjects (15.0%) in this study, as compared with gout prevalence (2.9%) in Hong Kong and worldwide (4;8;11;39), points to the hidden risk of gout. Potential individuals with hyperuricemia may be initially unaware of their own condition because they are asymptomatic (40). Asymptomatic hyperuricemia is a characteristic of metabolic syndrome which could lead to NCDs such as cardiovascular, liver and renal diseases (19;40). Teaching individuals at risk to monitor their own POC-UA level would timely enhance their understanding of their own condition, self-care ability and treatment compliance (34;35).

This study screening showed that male 25.0% (3/12) and female 13.4% (11/82) which agreed with most studies' findings that men are at higher risk of gout than women (2;39;40), Traditionally, women were more likely than men to become vegetarian (41;42). Indeed, many health seekers who went to the 2014 "Vegfest" were female.

Diet pattern and gout risk
Some studies found that vegetarians had higher SUA than meat eater (23) while others indicated vegetarians had lower SUA level (2). Although no significant difference was found between vegetarians and non-vegetarians in this study, it nevertheless revealed that among those with high POC-UA level, non-vegetarians counts were more than double of vegetarian counts. It is interesting to note that the Christians constitutes the lowest percentage of hyperuricemia subjects 3.7% (1/27) as compared with the Buddists 15.4% (4/26).

While it remains unclear if dietary pattern in terms of vegetarian and non-vegetarian has any effect on SUA level, the Hong Kong Centre for Health Protection in the article "Non-communicable disease Watch April 2019" recommended avoiding high purines food for gout prevention and management (4). Of which, meat and seafood were classified as high purine foods; dairy, bread and pasta were classified as low purine foods. Although this is in keeping with international recommendation (7;21;33;42), effects of individual foods and dietary pattern on SUA is still unclear, more vigorous research is needed so that health care professionals can give definite evidence-based dietary advice to prevent and control common lifestyle-induced NCDs including gout.

Education and gout prevention
Interestingly, the result revealed that the higher education level, the less hyperuricemia subjects (≤ primary: 23.5%, ≤ secondary: 16.0%, ≤ tertiary: 7.7%). In addition, age group ≥61 years old, groups with obesity and 2-3

chronic diseases had significantly more hyperuricemia subjects (32.1%, 23.5%, and 53.3% respectively) than other groups. This suggested that disease and lifestyle prevention knowledge is very important for gout prevention.

The American College of Rheumatology and recommended patient education on diet, lifestyle, treatment objectives, and management of comorbidities as the core therapeutic measures for gout (21;42). Even with these guidelines, management of gout was suboptimal (6;7). Researchers found patient education on diet and lifestyle not well implemented, assessment inconsistent, treatment competence poor (7;33). In Hong Kong, to better control hyperuricemia and to prevent acute gouty attack, health education focusing on self-assessment using POC-UA analyzer; and appropriate dietary pattern is beneficial, effective and convenient in keeping with the government's strategy and action plan to manage the health problem.

Limitations
There are several limitations to this study. First, the convenience sampling method may not be generalized. Second, the limited sample size may prevent the findings from being extrapolated. Third, the cross-sectional nature of the study offered no opportunity to detect changes over time.

Conclusion
This study examined the relationship between POC-UA and dietary pattern with an aim to assess hyperuricemia and any lifestyle intervention accordingly to reduce NCDs. The result supported that POC-UA testing is an effective assessment of hyperuricemia to estimate chronic ill heath such as metabolic syndrome or gout risks. Self-assessment of SUA by using POC-UA method will alert individuals at risks on appropriate dietary pattern and lifestyle management at an early stage. The study also revealed and emphasized the importance of health education programs and lifestyle intervention for self-care and NCDs prevention in the community of Hong Kong.

Research and Best Practice

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