Dietary Habits and Behavioral Patterns of Gout Patients in Humid Areas of Chongqing of China

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Abstract: The aim of this study is to analyse influences on gout patients in the humid areas of Chongqing, and to provide scientific evidence for the evaluation and application of health education interventions in different regions and populations. Patients diagnosed with gout in the humid areas of 12 communities and 12 counties of 8 heavily humid districts and counties of Chongqing from May 2017 to May 2018 were included in the study. The general information, dietary habits, behaviour, and cognition information were obtained from 3850 different degrees of gout patients by the use of questionnaires. Gout patients were divided into three levels: mild (blood uric acid continually increased); moderate (recurrent acute attacks of hyperthermia arthritis); severe (severe joint deformity and dysfunction). Statistical analysis of various factors influencing gout patients was made. The majority of the male gout patients were aged 35-50 years (1228 patients, or 31.9% of the total, $P < 0.05$). Female gout patients tended to be younger (aged 20-35 years) (467 patients, or 12.1% of the total, $P < 0.05$). Multivariate logistic regression analysis showed that the risk factor was poor life habits (OR = 1.234, 95% CI = 0.465, 2.356, $P < 0.05$), whereas protective factors included higher medication compliance (OR = 0.82, 95%CI = 0.126, 0.825, $P < 0.01$), milder intensity of physical exercise (OR = 0.936, 95%CI = 0.34, 0.876) , $P < 0.01$), higher frequency of attending health educational lectures (OR = 2.471, 95% CI = 2.347, 4.562, $P < 0.05$). Diet is closely related to gout and is a risk factor (OR = 1.116, 95% CI = 1.562, 2.879, $P < 0.05$). So as to improve health education for gout patients, improve the cognitive level and behavioural ability of gout patients on diet control, and provide targeted health education according to age, educational level and several abilities.

1. Introduction

Gout is an arthropathy associated with deposits of urate crystals, and is caused by disorders of uric acid metabolism. Gout is characterized by multiple complications, long disease duration, and severe attacks. The clinical features include hyperuricemia, recurrent acute monoarthritis, tophus formation from urate deposits, and tophus-induced chronic arthritis [1]. Purine is a substance that causes high uric acid [2].

Gout has long been a common disease in developed countries such as Europe and the United States. It has been one of the major health problems in the United States, affecting 8.3 million of the American population, and the incidence rate accounts for 4% of adults [3]. Annemans et al. [4] indicated that the incidence of gout was 1.4% in the UK and Germany in 2005. A study by Trifiro et al. [5] showed that in Italy, the incidence of gout increased from 0.67% in 2005 to 0.91% in 2009, and the incidence increased with age.

In the past 10 years, the number of patients with gout and hyperuricemia has increased from 0.22%--0.43% to 12.1%--25.2% in China [6]. Nationwide surveys have shown that the prevalence of

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gout is 0.15% to 0.67% [7]. Currie [8] found that the onset of gout in women was 10 year later than in men, and the prevalence in men was much higher than in women. The risk factor for gout in young people aged 30-39 years is hyperlipidemia, while the lifestyle of men and menopause of women have become important factors that induce gout in people aged 40-59 years. The use of diuretics and the decline of renal function are prone to induce gout in older people over 60 years old [9]. Frequent alcoholism, smoking or secondhand smoke, irregular lifestyle, and drinking coffee are likely to induce gout [10]. In the gout diet, alcohol consumption has long been considered as a risk factor for the disease [11,12]. Drinking wine and beer with high alcohol content can significantly increase the risk of gout [13,14]. Frequent intake of foods containing purines and high level of proteins also increases the incidence of this disease [15]. High purine foods such as seafood, animal offal, and broth can increase the risk of gout attack [16]. Gout severely reduces the quality of life, affects the daily life, and is even life-threatening to patients [18].

2. Materials and Methods

2.1 Research Methods.

This research started in May 2017 and was completed in May 2018. A total of 3850 different degrees of gout patients (1502 mild gout participants, 793 moderate gout participants and 1555 severe gout patients) living in 12 communities and 12 counties of 8 heavily humid districts and counties of Chongqing, including Yuzhong District, Yubei District, Shapingba District, Jiulongpo District, Qijiang District, Yinan County, Shuyang County, and Wuxi County, were investigated.

Inclusion criteria were: (1) patients with hyperuricemia diagnosed by community physical examination; (2) long-term residents in the humid areas of Chongqing; (3) patients who could take care of themselves, were willing to cooperate, and accepted the on-site services.

Classification criteria were: (1) mild (continuous increase in the blood uric acid and acute gouty arthritis); (2) moderate (recurrent acute attacks of gouty arthritis resulting in damage to multiple joints at various degrees); (3) severe (increasingly serious joint malformation and dysfunction, increased tophi, and increased joint volume).

In this study of key risk factors, a self-designed questionnaire was used. Face-to-face surveys were conducted by trained student investigators of Chongqing Medical University. The main purpose of the investigation was to understand the cognition of hyperuricemia and diet, as well as to document the treatment and medication of gout patients.

2.2 Questionnaire.

Health education lectures and questionnaires were arranged in 12 communities of 8 districts and counties in the humid areas of Chongqing. A total of 4000 questionnaires were distributed and 3850 valid questionnaires were returned, with an effective rate of 96.25%. The SPSS 23.0 statistical software was used for statistical analysis, and a double-blind method was used for data entry to reduce errors. The database was maintained by professionals. The mean and standard deviation of the variables in the database were calculated, and the awareness and behaviour of diet control were analysed. The Pearson chi-square test by a 2X2 contingency table, X^2 test, logistic regression, and other statistical methods were used for statistical analysis of data. $P < 0.01$ or $P < 0.05$ was considered to have a significant difference. The variable assignments are shown in Table 1.

3. Results

3.1. Overall Prevalence.

Among 3850 participants, the ratios of mild, moderate, and severe gout were 39% (794 males and 708 females), 20.6% (766 males and 27 females), and 40.4% (1475 males and 80 females), respectively. The age distribution was concentrated in the ranges of 20-35 years and 35-50 years. Most gout patients had the educational levels of bachelor or junior college, and most of the participants were working in government departments, enterprises, or institutions. The times to the

diagnosis of mild, moderate, and severe gout were within 1 year (843 cases, 21.9%), during 1-3 years (870 cases, 22.6%), and more than 5 years (1170 cases, 30.4%) respectively. As shown in Table 2, the onset times of gout at various degrees were mainly within 1 month (1013 cases, 26.3%) and within 6 months (1009 cases, 26.2%), respectively.

Table 1 Characteristics of gout patients at different degrees in the humid areas of Chongqing (n, %)

Variables	**Mild**	**Moderat**	**Severe**
Total	1502	793	1555
Gender			
Male	794	766	1475
Female	708	27 (0.7%)	80 (2.1%)
Age			
<20	601	54 (1.4%)	0 (0.0%)
20~35	466	408	193 (5.0%)
35~50	300 (7.8%)	273	793 (20.6%)
50~65	108 (2.8%)	54 (1.4%)	354 (9.2%)
>65	27 (0.7%)	0 (0.0%)	219 (5.7%)
Levels of education			
Primary school and below	54 (1.4%)	0 (0.0%)	135 (3.5%)
Junior/high school/technical	108 (2.8%)	166	381 (9.9%)
High school/high vocational	300 (7.8%)	219	327 (8.5%)
Bachelor/junior college and	1040	408	708 (18.4%)
Occupation			
Government	166 (4.3%)	219	466 (12.1%)
Technical/managerial/service	193 (5.0%)	81 (2.1%)	273 (7.1%)
Workers/employees in private	166 (4.3%)	193	219 (5.7%)
Individual merchants	54 (1.4%)	166	166 (4.3%)
others	928	135	435 (11.3%)
Time to the diagnosis of gout			
<1 year	843	0 (0.00%)	0 (0.00%)
1~3 years	8 (0.2%)	870	0 (0.00%)
3~5 years	0 (0.0%)	393	0 (0.00%)
>5 years	0 (0.0%)	566	1170
The time of your most recent			
Within 1 week	219 (5.7%)	108	193 (5.0%)
Within 1 month	354 (9.2%)	166	493 (12.8%)
Within 6 months	273 (7.1%)	300	435 (11.3%)
Within 1 year	193 (5.0%)	193	166 (4.3%)
Within 5 years	466	27 (0.7%)	273 (7.1%)

3.2 Prevalence and Life Habits of Gout Patients.

Of the 3850 participants, 847 cases (22% of the total) who were sick for less than one year were unclear how gout was caused by their poor habits. The population we investigated were not aware of their bad habits timed with the progression of the disease. At each stage of the disease, patients who were “unclear” about what bad habits might cause gout had the largest number (1694 cases, 44%, P <

0.05), followed by those who thought that "alcoholism" was the cause of gout (1120 cases, 29.1%, P < 0.05) (Table 2).

Table 2 Cognition of life habits of gout patients with different disease duration in humid areas of Chongqing

			Poor life habits				Total
			Alcoholism	Overwork	Inadeqate water intake	Unclear	
Disease duration (years)	<1	Count	273	214	166	847	1500
		% of Total	7.1%	5.7%	4.3%	22.0%	39.0%
	1-3	Count	354	135	108	193	790
		% of Total	9.2%	3.5%	2.8%	5.0%	20.6%
	3-5	Count	166	54	25	107	352
		% of Total	4.3%	1.4%	0.7%	2.8%	9.2%
	>5	Count	328	166	166	548	1208
		% of Total	8.5%	4.3%	4.3%	14.2%	31.2%
X2 value			51.715	41.947	31.002	75.762	56.534
P value			<0.05	<0.05	<0.05	<0.05	<0.05

3.3 Simple Linear Regression of Influence of Cognition, Behavior, and Dietary Habits in Gout Patients.

Gender, age, educational level, and poor life habits caused gout in 3850 participants. The irregular diet that caused gout, medical treatments, exercise intensity, frequency of attending health education lectures, and the relationship between diet and gout were statistically significant (P < 0.05), suggesting that they might be influence factors of gout (Table 3).

Table 3 Simple linear regression of influence factors for gout patients in humid areas of Chongqing

Variables		OR	S.E.	Sig.	95%CI
	Gender	2.133	.688	.000	(.0351, 8.975)
	Age	1.521	.621	.009	(.0410,2.396)
	Educational levels	1.831	.061	.005	(1.240,8.765)
	Occupation	.530	.864	.426	(.906,2.897)
	Recent onset time	.520	.238	.658	(.491,1.832)
	Bad habits that caused gout	1.421	.223	.008	(.885, 3.395
	Irregular diet that caused gout	1.761	.351	.022	(.646, 2.274)
	Daily regular diet	2.894	.263	.571	(.507, 2.628)
	Regular examination of blood uric acid	.877	.106	.421	(.405, 1.735)
	Ideal level of blood uric acid	1.460	.651	.280	(.537, 2.014)
	Complications of gout	1.133	.217	.935	(.933, 1.470)
	Symptoms caused by improper treatment of gout	1.217	.319	.818	(.527, 1.047)
	Symptoms after the onset of gout	.793	.959	.573	(.649, 3.974)
	Medical treatment of gout	1.723	.479	.009	(.039, 1.582)
	Compliance of medication	1.939	.582	.959	(.115, 1.748)
	Exercising status of gout patients	.470	.443	.748	(.390, 1.316)
	Exercise intensity of gout patients	4.086	.161	.009	(.093, 3.954)
	Changes in symptoms after exercise	1.822	.752	.681	(.234, 7.112)
	Education situation of accompaniers	.850	.641	.616	(.399, 2.093)
	Frequency of attending lectures	1.898	.510	.005	(.657, 3.680)
	Development of a good lifestyle	.285	.237	.418	(.274, 1.124)
	Proportion of everyday nutrients	.139	.626	.094	(.300, 1.919)
	Relationship between diet and gout	1.936	.204	.001	(.028, 1.919)

3.4 Multivariate Regression Analysis of Influence Factors of Cognition, Behavior, and Dietary Habits in Gout Patients.

Statistically significant single factors were analyzed with the multivariate logistic regression model. Results showed that poor life habits, irregular dietary choices, medical treatments, exercise intensity, frequency of attending lectures, and the relationship between diet and gout were statistically significant ($P < 0.05$), suggesting that they were influence factors of gout (Table 4).

A risk factor for gout was poor cognition of life habits (OR = 1.234, 95% CI = 0.465, 2.356, $P < 0.05$), which included alcoholism, smoking, irregular eating habits, and long-term hunger (OR = 1.007, 95% CI = 0.376, 1.256, $P < 0.01$). Compliance of medication could be a protective factor for gout (OR = 0.82, 95% CI = 0.126, 0.825, $P < 0.01$). In the behavioral area, protective factors included milder exercise intensity (OR = 0.936, 95% CI = 0.34, 0.876, $P < 0.01$) and higher frequency of attending health educational lectures (OR = 2.471, 95% CI = 2.347, 4.562, $P < 0.05$). High-salt, high-fat, and high-sugar diets were closely related to gout and were risk factors for the disease (OR = 1.116, 95%CI = 1.562, 2.879, $P < 0.05$).

Table 4 Multivariate regression analysis of influence factors for cognition and behavior of gout patients in humid areas of Chongqing

Influence factors	**B value**	**WaldX^2 value**	**P-value**	**OR value (95%CI)**
Bad life habits that cause gout	0.21	13.884	<0.05	1.234 (.465,
Irregular diet that cause gout	0.007	14.438	<0.01	1.007 (.376,
Medical treatment of gout	-0.198	17.255	<0.01	0.82 (.126, 0.825)
Exercise intensity of gout patients	-0.066	17.671	<0.01	0.936 (.034, .876)
Frequency of attending lectures	0.905	381.275	<0.05	2.471 (2.357,
Relationship between diet and gout	0.11	123.114	<0.05	1.116 (1.562,

4. Discussion

4.1 Analysis of Cognitive Status and Behavioral Habits of Gout Patients.

The scoring percentage of the cognitive status of gout patients was 52.5%, which was at a medium level. 44% of patients were unclear about which bad life habits could be the causes of gout (1694 cases, 44% of total, $P < 0.05$), and 29% of patients thought that gout was caused by "alcoholism" (1120 cases, 29.1% of total, $P < 0.05$). Patients had awareness of high-salt, high-fat, and high-sugar products, but they were unclear about the proportion of daily intake. The scoring percentage of behavioral habits of gout patients was 35.2%, which was at a low level. The above facts indicated that, although patients were aware that alimentary control was necessary for the treatment of gout, they were unclear about how to control the daily food intake and types. In diet control, the dietary habits of gout patients had the highest scoring percentage (68.57%), being followed by the relationship between diet and gout (63.46%) and the ideal level of blood uric acid (55.76%), indicating that health education could improve the diet cognition of gout patients. However, the scoring rate of daily nutrient proportion was only 31.67% due to various restrictions in the daily life of patients. Health education practitioners should strengthen and promote the dissemination of nutrition knowledge to instruct patients the rational diet including what and how much they should eat.

In terms of behavioral scores of the gout patients, the daily regular diet had the highest scoring percentage (65.33%), followed by the exercise status (42.51%), regular examination of blood uric acid (36.87%), a good lifestyle (32.37%), education of companions (28.28%), long-term adherence to low-purine diet (23.54%,) and frequency of participation in lectures (17.72%). Our investigation showed that, although most patients had regular dietary habits, they were not able to adhere to long-term low-purine diets and lacked long-term persistence and volition to resist the temptation of delicious food [30]. Therefore, limiting the intake of purine foods to reduce exogenous nucleoprotein

and lowering serum uric acid levels are important to prevent or alleviate acute attacks of gout, to reduce the deposition of urate in the body, as well as to prevent the formation of uric acid stones [31-33]. Generally, gout patients did not continue with physical exercise, nor could they regularly examine the blood uric acid levels. Patients did not pay enough attention to the disease and its prognosis, and could not change the poor lifestyle that was responsible for illness. Therefore, patients' family members or friends should supervise and urge patients to end the bad habits [34]. The nursing care strategies with interventions of cognition and behavior and intensive psychological treatment should be widely used and popularized [35]. Gout patients should attend health education lectures and activities more regularly, which could help their treatment of gout.

4.2 Corresponding Countermeasures in the Health Management.

The purine-rich food intake and the incidence of gout have continuously increased with improved living standards. The incidence age has gradually become younger, with significant increase in the recurrence rate. In addition, the choice of a variety of foods and the temptation of food have made diet control particularly important for patients with gout. Failure of diet control has been the main cause of recurrent gout. How to help gout patients to continue with diet control is an urgent question for medical personnel and health education practitioners. The principles of gout diet include low-purine, low-protein, low-fat, and low-calorie diets and adequate water intake [36].

In the management of health education, the interactions between doctors and patients, including making patients understand what gout is, the prevention of gout, treatment after gout, and the prognosis and recuperation after recovery, could be the specific operational methods [37].

The specific steps include dietary care: (1) Low-purine, low-calorie, low-fat, and low-protein diets, and (2) Total caloric restriction. The proportion of fructose in carbohydrate intake should not be too large because fructose can increase the production and excretion of uric acid. The intake of sucrose should be reduced because half of the sucrose metabolites are fructose [38]. Dietary fat should be limited to 0.6~0.8 g/kg per day in order to reduce the discharge of uric acid. Daily dietary protein intake should be restricted to 0.8~1.0 g/kg and patients should be encouraged to eat more vegetables and high-quality protein foods such as milk and eggs that do not contain nucleoproteins [33]. (3) Fish and poultry meals such as squid, fish eggs, seafood, and various soups or broths made from meat and poultry should be restricted in the acute phase of the disease. Patients should eat more vegetables. (4) Patients must stop smoking and drinking alcohol. Barbecue and beer are the main causes of gout in the humid areas of Chongqing. Coffee and tea are not strictly restricted, but the quantity should be controlled. Drinking strong tea should be avoided [34]. (5) Attention should be paid to ingredients in food. For example, people in the humid areas of Chongqing prefer heavy tasting foods. Spicy condiments such as chili, pepper, and ginger can stimulate the nervous system to induce acute attacks of gout and should be avoided [34-36].

Various health education methods can be adapted to specific conditions. People with higher educational levels can use corresponding application software, public Wechat accounts, and small videos to obtain information [37]. For people with lower educational levels, printed educational materials with pictures and texts, classes in the form of question-and-answer, and educational methods with encouragement and awards could be adopted to make the knowledge easily accepted. In addition, it is also recommended that experts from the medical education, nutrition, or health education departments of hospitals present lectures in the community that guide patients how, what and how much they should eat. The nutrient ingredients and the daily intake of food should be specifically taught to patients. Education of rational diets and healthy lifestyles should guide patients to control their diets efficiently [38]. The dangers of food or lifestyles that may cause gout should also be popularized.

5. Conclusions

General misunderstandings of the behavior and cognition of gout in the normal population are due to insufficient knowledge and limited understanding of gout in the mainstream media. Not enough social attention is paid to this disease. According to clinical epidemiological studies, the worldwide

incidence and prevalence of gout continue to increase. In recent years, gout has become a disease that greatly affects people's daily life and quality of life. Most gout patients lack knowledge about the prevention and the treatment of this disease [39]. Gout is a common metabolic disease with the involvement of joints. Therefore, it is clinically classified in the category of rheumatic diseases. In recent years, gout has become a major disease in the field of rheumatology and its incidence has greatly increased. Gout has become a disease as serious as coronary heart disease and diabetes, and significantly influences people's quality of life and health status. Medical personnel should further the education of this disease [40].

In summary, self-examination by gout patients can be enhanced, the mistreatment and misdiagnosis can be reduced, and the prognosis of gout patients can be improved by strengthening the education of knowledge relating to gout in the Chinese health system.

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