

An Analysis of the Influencing Factors of Gout

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Abstract: Gout is an inflammatory disease that is linked to uric acid disturbance. This kind of metabolic disease is also thought of as a type of arthritis. This paper studies the factors causing gout, analyzes the results based on existing literature and research results, and discusses the two possible factors, lifestyle factors and genetic factors, which may take responsibility for the cause of gout. In this paper, diet and fitness are included in lifestyle factors. The influences of a high-purine food like seafood and alcohol are mentioned in the diet part with a high-fat and high-sugar diet. In the fitness part, the BMI and the exercise factor are linked with the cause rate of gout to analyze the relationship between them. For the genetic part, two genetic factors, SLC22A12 and SLC2A9, are analyzed for the cause of gout. Finally, the conclusion is that gout isn't only caused by the lifestyle of people or genetic factors. The bad daily lifestyles, like unhealthy daily diets and little exercise, accumulated together with the genetic factors. Then, consequently, they cause gout, which means they both have an effect on the formation of gout.

Keywords: Gout, Cause of Gout, Dietary Factors, Exercise Factors, Genetic Factors

1. Introduction

Gout was recorded in the world since the 5th century BC, which is about 2500 years ago. Currently, about 1% to 4% of the world's population has gout [1]. The signs of gout include severe pain accompanied by inflammatory symptoms like swelling, erythema, warmth, and tenderness [2]. It was described as the “king’s disease” in ancient times, which means that gout was a disease of “wealth got by the royal palace and nobles at that time. Gout is a systemic disease that results from the deposition of monosodium urate crystals (MSU) in tissues. Uric acid is excreted through the kidneys, generally due to the absorption of a large amount of purines by the body, coupled with the influence of different factors, resulting in the crystallization of urate precipitates into the joints and tissues around the joints, resulting in the corresponding inflammation. Increased serum uric acid (SUA) above a specific number is a requirement for the formation of uric acid crystals. MSU crystals can be deposited in all tissues, mainly in and around the joints, forming tophi, which is used to identify gout [3]. The influence of food, such as a high-purine diet, will increase the risk of gout, which is an important factor that causes uric acid metabolism disorders. Many of the scholars had studied the relationship between the gout and the exercise, and they found that there are some obvious relationships between them. The academic research on this is relatively mature, and that means we can find many related articles about it online. For example, in 2008 a report analyzed this question in detail, which had scientific significance to the public [4]. The two potential causes of gout — genetic

and lifestyle factors — are examined in this work along with their effects on the condition. The results are analyzed based on research findings and current literature.

2. Lifestyle — Diet

Unhealthy eating habits are one of the main causes of gout. Purine, which plays a very important role in energy supply, metabolism regulation, and coenzymes, is oxidized to uric acid in the body and causes gout. When people are eating some foods that are rich in purines, such as seafood, there will be a higher probability of suffering from gout. In research in 2004, the researchers had recorded about 730 examples of gout during 12 years. By using questionnaires, this research aimed to find the relationship between diet and gout. They found that purine-rich seafood was more likely to cause gout than meat and also found that the take-in of vegetables that have a high purine level is not connected to the rising risk of gout [5].

Alcohol is also a factor that cannot be ignored. The reason why drinking can cause gout is first because of the high purine content of wine, which is a high-purine food, and having too much alcohol may cause the body to consume too much purine, which then leads to the increase of uric acid. Secondly, alcohol may interfere with the normal excretion of uric acid after entering the human body, leading to the accumulation of uric acid, which may induce gout. In another research, it emphasized the important role of alcohol in the cause of gout. In 2008, based on 28,990 men, the writer did this research in order to find the effect of alcohol on gout. In this research, it said that only 15g of alcohol consumption can increase the risk of gout by 93% [4]. This striking data can explain why taking in too much alcohol is one of the main causes of gout.

Besides the two high-purine-level diets, a high-sugar diet is also associated with gout. For example, the sugary drinks. It is a typical example of a high-sugar diet. A can of cola(330ml) contains 35g of sugar, which is much more than the amount of sugar which the adults are suggested to take in per day(30g) [6, 7]. The sugar in sugary drinks is absorbed by the body and metabolized in the liver into glucose and fructose. The metabolism of fructose leads to the accumulation of lactic acid, which inhibits the excretion of uric acid, and the accumulation of uric acid increases the risk of gout. According to an article, a high-sugar diet participates in kidney disease and uric acid metabolism disorders. If the people take in too much sugar that reaches the upper limit of the body, the liver will not be able to work normally and then the formation of the uric acid will be accelerated [8, 9]. Also, a high-fat diet is a cause of gout. To find the factors that affect hyperuricemia, the research used the data from 14624 adults representative of the US civilian noninstitutionalized population in 2019. In that research, it mentions that a high-fat diet caused obesity, which was connected with 60% of hyperurice cases [8, 10]. Therefore, these unhealthy diets are considered the greatest cause of gout.

3. Lifestyle — Fitness

Although diet is an important factor in causing gout, other factors should not be ignored. Physical health is also an important factor in determining gout. The first factor to judge a person's fitness level is the BMI. It is measured by the height and mass of people. Theoretically, body weight is related to serum uric acid, and obesity reduces the clearance of uric acid in the body and increases its production. In a study which has a data population of 28,990, the relationship between the BMI of people and the percentage of the paroxysm of gout is presented. It showed that the risk of gout increases with BMI. Men with a comparatively healthier BMI ($BMI < 20$) have an 85% lower risk of gout than the men who are overweight ($BMI > 27.5$) [4]. This trend not only displays the directly proportional relationship between BMI and gout but also explains that people who are more obese have a higher risk of developing gout.

In addition to BMI, exercise is also included in fitness factors. In theory, doing exercises can speed up blood circulation; this can also promote the excretion of sweat, which may make part of the uric acid, along with sweat, excrete out of the body, thereby reducing the amount of uric acid in the blood. If the amount of uric acid decreases in the blood, the formation of uric acid crystals will be harder. Then, they cannot precipitate in the joints and this will reduce the possibility of gout. In an article which is based on 228 people to find the relationship between physical activities and gout, compared with the least active men, those who ran longer than 8 km/day or at a speed of 4.0 m/s had 50% and 65% lower risk of gout, respectively [4, 11]. Researchers also present data to elucidate the correlation between exercise and gout. The researchers concurrently showed the running distance (km/week) and the content of uric acid in the patient's blood (mg/dL). When the running distance is 16 to 32 kilometers per week, the concentration of uric acid will be about 5.60 mg/dL. When the running distance is 32 to 48 kilometers per week, the concentration slightly decreases to about 5.50 mg/dL. When the running distance increases to 48 to 64 kilometers per week, the concentration of uric acid decreases again to about 5.43 mg/dL. Finally, when the running distance increases to over 64 kilometers per week, the concentration finally drops to about 5.14 mg/dL, which is about 8% lower than the original value [11]. In this data, the average decline was about -0.006 mg/dL per km/wk run [4]. That means having exercise can reduce the possibility of gout successfully, and conversely, lack of exercise will make people get gout more easily.

4. Genetic factors

Except for the lifestyle factors, the genetic factors are also an essential part of the cause of gout. For example, the SLC22A12. It is the first specific urate transporter to be identified, and it also affects the formation of gout. From research about it, the researchers found that it affected the variance of serum uric acid by 0.13% [12]. There is also another genetic factor, which is called SLC2A9, that affected the cause of gout. It is identified as an important regulator of serum urate, uric acid excretion, and gout. Due to research in 2008, it is most pronounced in female patients, which is 5-6% higher than male [13]. The loss of function mutations in SLC22A12 and SLC2A9 alleles cause hyperuricemia through reduced urate uptake and uncontrolled urate secretion. In research done in 2012, it suggests that a large proportion of the genes that are linked to the formation of gout are related to the renal urate transport system. The genes like SLC22A12 and SLC2A9 are used to regulate the serum uric acid level in people's bodies, and serum uric acid concentration is mainly determined by the balance of renal uric acid absorption and secretion. The article also mentions that the loss of function of these genes leads to less absorption of urate and opposed secretion of urate, which will cause hereditary hypouricaemia [14].

5. Conclusion

All in all, gout isn't only caused by the lifestyle of people or genetic factors. The bad daily lifestyles, like unhealthy daily diets and little exercise, accumulated together with the genetic factors. And then, consequently, they caused gout. Although this study had shown many causes of gout, it still has many limitations. For example, compared to the huge amount of information about how diet and exercise caused gout, articles about how genes caused gout are obviously fewer. That means the study on how genetic factors affect gout is not enough. Future research will combine specific experiments and models to deeply analyze the impact of a certain factor on gout.

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