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A Couple Cups of Coffee a Day Keeps Gout Away: A Look at the Inverse Relationship Between Coffee Consumption and Incidence of Gout

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**Abstract**

**Background:** Gout is the most common form of inflammatory arthritis, affecting an estimated 6.1 million people in the United States alone. There are currently some widely accepted dietary and medical management treatments for gout; however, prevention strategies for this disease prior to diagnosis are lacking. Coffee has been shown in multiple studies to have a protective property against gout and high levels of uric acid associated with gout. Currently, coffee is not recommended as a preventative measure against developing gout and its symptoms. Can consumption of coffee reduce the incidence of gout and gout symptoms?

**Method:** An exhaustive search was conducted using Medline-OVID, CINAHL, Google Scholar, and Web of Science using the keywords: gout and coffee. Relevant articles were assessed for quality using GRADE.

**Results:** Two observational studies met inclusion criteria and were included in this systematic review. The two studies were prospective observational studies that showed a significant inverse correlation between coffee consumption and gout incidence. The relationships always correlated to coffee intake regardless of caffeine levels in the coffee. There was no correlation found between tea and gout, negating the relationship being due to caffeine but rather coffee itself.

**Conclusion:** It seems that increased coffee consumption could decrease the occurrence of gout. A recommendation to increase coffee consumption to prevent risk of gout can be made to certain patients. More research is needed to determine the mechanism of action of the constituents of coffee.

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**Keywords**
Gout, coffee, hyperuricemia, human

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A Couple Cups of Coffee a Day Keeps Gout Away:
A Look at the Inverse Relationship Between
Coffee Consumption and Incidence of Gout

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A Clinical Graduate Project Submitted to the Faculty of the
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Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

[Redacted for privacy]
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Table of Contents

Biography ................................................................................................................................. 2
Abstract ................................................................................................................................. 3
Table of Contents .................................................................................................................. 4
List of Tables .......................................................................................................................... 5
List of Abbreviations ............................................................................................................ 5
Background ............................................................................................................................ 6
Methods ................................................................................................................................. 7
Results ..................................................................................................................................... 8
Discussion .............................................................................................................................. 12
Conclusion ............................................................................................................................. 15
References ............................................................................................................................. 16
Table ....................................................................................................................................... 18
List of Tables

Table I: Characteristics of Reviewed Studies

List of Abbreviations

ACR…………………………………………………………American College of Rheumatology
BMI……………………………………………………………………….Body Mass Index
CI………………………………………………………………………Confidence Interval
NSAIDS………………………………………….Non-Steroidal Anti-inflammatory Drugs
RCT……………………………………………………………..Randomized Control Trial
RR…………………………………………………………………………….Relative Risk
A Couple Cups of Coffee a Day Keeps Gout Away: A Look at the Inverse Relationship Between Coffee Consumption and Incidence of Gout

BACKGROUND

Gout is one of the most prevalent forms of inflammatory arthritis affecting an estimated 6.1 million people in the US alone. This disease starts with unexpected attacks, but can become chronic with flare ups that cause joints to suddenly become red, hot, swollen, and tender. The big toe, ankle, and knee are especially susceptible to gout attacks and can experience extreme excruciating pain during flares. These symptoms can last anywhere from a couple days to weeks if left untreated.

Gout is caused by the buildup of uric acid in a joint which crystallizes and become the instigator of irritation and inflammation of the joint. This buildup of uric acid can be due to the body’s overproduction and/or under excretion of this metabolic byproduct through the kidneys; however, the most common cause is under excretion. No matter the mechanism, high levels of uric acid (hyperuricemia) is a main contributor to the development of gout. Gout mostly affects men over the age of 30 and women who are post menopausal.

The treatment for gout is through two avenues of providing symptomatic relief of acute attacks and lifestyle changes to help prevent future symptoms by avoiding high uric acid levels in the body. For symptomatic relief the medication options are NSAIDs, steroids, and colchicine. Probencid is a medication that helps prevent the reabsorption of uric acid in the kidneys and therefore increases uric acid excretion. Lifestyle changes are encouraged for further prevention of flare ups. One lifestyle change is starting a low purine diet. Ingested purines are broken down by the body into uric acid and are found in many foods like red meat, beer, and seafood. Allopurinol is a medication that helps prevent the conversion of purines into uric acid,
thus lowering the amount of uric acid production in the body.\textsuperscript{5} This regimen of lifestyle change through diet and medications works in most cases of gout; however, with medications there are always the risk of side effects.\textsuperscript{4,5} Probenecid has many side effects which include possible headache, rash, and vomiting to full blown anaphylaxis.\textsuperscript{4} Allopurinol also has related side effects that range from rash, diarrhea, and liver irritation to a hypersensitivity reaction that can mimic third degree burns on the skin.\textsuperscript{5} Granted, not every patient experiences these side effects when taking these drugs, but the risk is always there.

Everyday more than 150 million Americans consume coffee at the rate of about 2 cups per day.\textsuperscript{6,7} Since coffee is currently such a widely consumed commodity, the consumers should have access to the possible benefits along with risks of what they are putting into their bodies. Currently, there are a handful of studies\textsuperscript{8-10} that have shown an inverse relationship between increased coffee consumption and hyperuricemia, but these studies lack strong methodology. This possible connection between coffee and gout could be promising as a safer and easier alternative for Americans to reduce their risk of developing symptoms of gout in the future that does not require a prescription. This review aims to identify a correlation between high coffee consumption and reduction in gout incidence or symptomatology.

\textbf{METHODS}

An exhaustive search of available medical literature was conducted using Medline-OVID, CINAHL, Google Scholar, and Web of Science using the keywords: gout and coffee. The search was then narrowed to include only English language articles. The bibliographies of the articles were further searched for relevant sources. Articles with primary data evaluating an inverse relationship between coffee consumption and gout were included. Relevant articles were
assessed for quality using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE). See Table 1.

RESULTS

The initial result of the search yielded 32 articles for review. After screening relevant articles for primary data and human studies, a total of five articles met inclusion criteria. These articles include two observational studies that had the primary end point of gout and gout symptoms and three survey studies. The 3 survey studies were not included in this review because they focused more on uric acid levels rather than patients actually having symptoms of gout and being diagnosed with the disease.

Coffee Consumption and Risk of Incident Gout in Men

This observational prospective study looked at a longitudinal study that followed male health professionals over a period of 12 years through the use of questionnaires. This study was interested in showing a potential for the ingestion of coffee, decaf coffee, tea, and caffeine to reduce the risk of gout. This study proposed several speculated mechanisms that would suggest there is an inverse relationship to be found between coffee and gout that include: possible protective properties in caffeine found in coffee and tea that inhibit purine breakdown into uric acid which are similar to properties in allopurinol, and the fact that coffee might help increase uric acid excretion due to its diuretic property, and ability to lower insulin levels by increasing insulin sensitivity in the body.

The researchers used data from the Health Professionals Follow-up Study which included 51,529 males. At baseline of the study there were 48,642 men who completed the survey of their coffee intake and these men were included in the study. The men who were excluded were those who had the diagnosis of gout at the beginning of the study in 1986, which were 2733 (5.7%).
There is an assumed 40 participants who were not included in this study due to loss of follow up. This left 45,869 participants at the beginning of the study of whom 91% were white and between the ages of 40-75. These participants completed questionnaires every 4 years about dietary intake of more than 130 food items including coffee and tea and a health questionnaire every 2 years. These participants were also asked to report the frequency of consumption of these beverages. On the 2 year questionnaire the participants reported health status, issues, and medication. If the individual reported having received the diagnosis of gout from a medical professional, they were mailed another questionnaire that was the American College of Rheumatology (ACR) Survey Gout Criteria. If the individual answered positive to 6 or greater out of the 11 of the criteria, this would confirm the diagnosis of gout.

After the 12-year period, coffee was shown to have the most significant inverse relationship with the occurrence of gout. The multivariate relative risks (RR) for developing gout were calculated according to the different amounts of coffee consumption. The multivariate RR took into account age, total energy intake, body mass index (BMI), diuretic medication use, hypertension, renal failure, and consumption of alcohol, meats, seafood, purine-rich vegetables, dairy, and vitamin C into the calculation of RR. There were 5 different categories of cups of coffee consumed per day which were 0, <1, 1-3, 4-5 and 6 or greater. The results were the following values of 1.00, 0.97 95% CI (0.78-1.20), 0.92 95% CI (0.75-1.11), 0.60 95% CI (0.41-0.87), and 0.41 95% CI (0.19-0.88) respectively. There was also a slight inverse relationship between decaf coffee and gout with 4 categories of cup consumption of 0, <1,1-3, >4. The multivariate RR were 1.00, 0.83 95% CI (0.70-0.99), 0.67 95% CI (0.54-0.82) and 0.73 95% CI (0.46-1.17) respectively. Finally no relationship could be found for caffeine consumption and risk of gout with all confidence intervals crossing 1. The study also compared the incidence of
gout in participants who consumed 4-5 cups per day and 6 or great cups per day to no coffee at all. This comparison showed that there was a 40% lower risk of gout when individuals consumed 4-5 cups a day and a 59% reduction in the occurrence of gout when an individual consumed 6 or greater cups of coffee a day.\textsuperscript{12}

The authors identified limitations in the fact that their information was gathered through questionnaires and depended on individuals’ self-reporting. Also the individuals who participated in this study were medical professionals and mostly of Caucasian descent. The authors concluded that there is an inverse relationship found between amount of coffee consumed and gout symptoms regardless of caffeine levels in the coffee. The more coffee consumed by the individual, the more their risk of experiencing gout symptoms decreased. This statement is founded in the fact that there was some inverse relation with gout symptoms and decaf coffee. This inverse relationship still held true when the authors performed a stratified analysis adjusted just to age, BMI, and alcohol intake and also when using the multivariate analysis to include variables like BMI, alcohol intake, high blood pressure, and meat consumption. Moreover, there was no clear association between gout symptoms and intake of tea, which also has caffeine.\textsuperscript{12}

**Coffee Consumption and Risk of Incident Gout in Women: the Nurses’ Health Study**

This study\textsuperscript{13} is another prospective observational study that gathered information over a 26-year period via questionnaires in the Nurses’ Health Study. This study was interested in showing a potential for the ingestion of coffee as having an inverse relationship with gout. They looked at the effects of decaf coffee, tea, and other sources of caffeine such as that in chocolate to identify a reduction of the risk of gout. The researchers wanted to have a study that looked specifically at the potential of coffee’s effects on gout in women, particularly post menopausal,
since no other study up to this point had focused on females. They theorized the same speculations of the inverse relationship to be found between coffee and gout that include: possible protective properties in caffeine found in coffee and tea that inhibit purine breakdown into uric acid which are similar to properties in allopurinol, and the fact that coffee might help increase uric acid excretion due to its diuretic property, and ability to lower insulin levels by increasing insulin sensitivity in the body.\textsuperscript{13}

The participants were part of The Nurses’ Health Study that began in 1976. All participants were registered nurses in 11 different states. These participants filled out health questionnaires and food-frequency questionnaires every 2 years from 1980-2006. Their ages ranged from 30-55. Individuals that were included in the study were 89,433 nurses who completed the diet questionnaire every 2 years from 1980-2006. The participants also provided information on their weight, medications (including diuretics), and medical conditions like hypertension. The participants that were excluded from the study were women who already were diagnosed with gout prior to the start of the study and those women who failed to complete more than 10 items on the diet questionnaire that was first sent out in 1980. If the women provided the information that they were diagnosed with gout, the individual filled out the ACR gout survey.\textsuperscript{14} If the individual answered positive to 6 or greater out of the 11 of the criteria, this would confirm the diagnosis of gout.\textsuperscript{13}

After the 26-year period the study showed that there was an inverse relationship between the amount of daily coffee consumed and the occurrence of gout. Data was presented as multivariate relative risk to include multiple factors in the analysis of data. The amount of coffee consumed was identified as 237mL = an 8 oz. cup of coffee. There were 4 different categories for amounts of coffee consumed which were 0 mL, <237mL, 238-947mL and greater than 948 mL.
of coffee consumed daily. The RR for these categories were 1.00, 0.97 (95% CI 0.78-1.20), 0.78 (95% CI 0.64-0.95), and 0.43 (95% CI 0.30-0.61) respectively. For decaf coffee the categories were 0, <237, and greater than 237mL. The RR inverse relationship was less impressive with 1.00, 1.02 (95% CI 0.85-1.22) and 0.77 (95% CI 0.63-0.95) respectively. The women who drank 1-3 cups per day had a 22% less risk of gout and the group of greater than 4 cups per day drinkers had a 57% drop in risk for gout when compared to non-coffee drinkers.\textsuperscript{13}

The authors identified limitations in the fact that their information was gathered through questionnaires and depended on individuals' self-reporting. The individuals who participated in this study were all nurses and women. The study failed to identify the race of the participants. There was also a lack of social and gender variance of the participants. However, the strength is in the fact that gout symptoms are seen in postmenopausal women, who were included in this study.\textsuperscript{13}

In conclusion, the authors stated that this study was the first to show an inverse relationship between symptoms of gout and amount of coffee consumed in women. This correlation held true even when the researchers performed a stratified analysis of the data to include factors like BMI, alcohol intake, use of diuretic medication, and low-fat dairy intake when compared to just age adjusted RR. They also stated that this study showed that there is no clear association between caffeine intake and symptoms of gout.\textsuperscript{13}

\textbf{DISCUSSION}

Currently there are no solidified recommendations for the prevention of gout given to patients prior to diagnosis. Rather, clinicians are well versed in the treatment of gout and prevention in further attacks once the patient has had their first symptomatic event. The studies\textsuperscript{12,13} mentioned previously have shown that there can be a preventative measure for people
before they develop gout symptoms all together. Specifically, patients who drink one to five cups of coffee a day may be reducing their risk of gout by 22-57% and this risk is further decreased with higher consumption of coffee.\textsuperscript{12,13} This correlation has been shown to be stronger in males than females, however, the correlation does exist in both genders. With these studies in mind, coffee could be offered as a way to prevent gout and lower uric acid levels. Coffee can also be thought of as an addition to current gout therapy including allopurinol and probenecid. With further research, coffee may even be demonstrated to lower prescriptions written and the number of gout flares. Coffee may lead to new drugs and may even be an alternative for those who are allergic, do not wish to take medication, or want more of a naturalistic approach towards their gout or hyperuricemia.

Coffee consumption does, however, come with risks that include increased anxiety, arrhythmias, and withdrawal symptoms. Because coffee also has some risk attached to its consumption, these risks would have to outweigh the benefits in order for coffee to be suggested by medical providers to be consumed by patients. The preventative benefits of high coffee consumption can be suggested as beneficial to those patients who have not yet been diagnosed with gout and who already consume four or more cups of coffee a day. A provider could also encourage maintaining this high coffee consumption in these patients as long as other factors do not increase risk to the patient. Patients who should not be encouraged to increase coffee intake would include those who already have increased risk of dangerous heart arrhythmias, severe anxiety or multiple severe stomach ulcers. It is up to the medical provider and the patient to have an informative conversation about the risks and benefits of coffee consumption. It is through this discussion that they can decide together if four or more cups of coffee a day would actually be beneficial in preventing gout or even helping with the current diagnosis of gout.
There are limitations to the current studies. The biggest limitation perhaps is that fact that they have all been observational studies and no randomized trials have been performed. The current studies are on limited populations such as the Japanese and Americans. There needs to be a study performed on other racial groups especially African-Americans. The prevalence of gout in black males is about 10.9%, whereas in white males it is 5.8%.\textsuperscript{15} There also needs to be more studies for postmenopausal women since this is also a group that has an increased incidence of gout.\textsuperscript{1,2} There is existing variability found in the fact that there was no standard “cup of coffee” that was consistent as an actual amount in ounces. The two studies\textsuperscript{12,13} that were concerned with gout in particular relied on the diagnosis of gout by a healthcare professional and then the reporting of the individual instead of reviewing medical charts of all participants. Only about 50 medical charts were reviewed to concur the diagnosis of gout with the self-reporting of gout.\textsuperscript{12,13} Even with these limitations, there is a clear inverse relationship between gout and increased coffee intake. There are other studies\textsuperscript{8-10} that support this inverse relationship that were not included in this review. These studies found an inverse relationship between coffee consumption and hyperuricemia. When individuals consumed high amounts of coffee, they had lower uric acid levels in their blood.\textsuperscript{8-10} Since high uric acid levels are associated with gout, this information supports coffee’s benefits with this disease.

Recommendations for further studies would be to have a randomized control trial (RCT). There needs to be more information on high-risk groups like African-Americans and postmenopausal women. Other studies could look at participants who currently have gout and assess if coffee can reduce flare ups when compared to no treatment and/or currently accepted conventional treatments. Finally there needs to be more research on the mechanism of action that coffee has that allows it to play a role in the reduction of uric acid in the body and therefore
reduction in gout as well. There is a lot that we still don’t know about this commonly consumed beverage. For example, the studies also mentioned that there could be a connection between coffee consumption and increasing insulin sensitivity.\textsuperscript{12,13} More research into the mechanisms of coffee consumption in connection with gout and other chronic diseases could lead to new avenues of treatment.

CONCLUSION

Coffee has been demonstrated to show a protective effect against gout, particularly in males. There are risks involved with intake of coffee and depending on the patient’s medical history, coffee might not be the best treatment. Nevertheless, based on these studies, coffee does have a positive affect when it comes to gout prevention. This benefit is cost effective, comes with little risk and is widely accessible by most of the world’s populations. Coffee could be considered as a preventative resource that can be recommended to patients who have not yet been diagnosed with gout. It can also have the potential to prevent gout flares in those who are already diagnosed with this disease. Further research into the protective effects of coffee in the form of randomized trials would be helpful to the future of medicine. Research as to the mechanism of action of the constituents of coffee is needed.


### Table I. Characteristics of Reviewed Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Limitations</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Inconsistency</th>
<th>Publication bias likely</th>
<th>Quality</th>
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<td>Choi et al&lt;sup&gt;12&lt;/sup&gt;</td>
<td>Serious&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not serious</td>
<td>Not serious</td>
<td>Not serious</td>
<td>Not likely</td>
<td>Very low&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Choi and Curhan&lt;sup&gt;13&lt;/sup&gt;</td>
<td>Serious&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not serious</td>
<td>Not serious</td>
<td>Not serious</td>
<td>Not likely</td>
<td>Very low&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
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<sup>a</sup>Lacked representation of variable ethnicities, Choi et al<sup>12</sup> was mostly Caucasian males and Choi and Curhan<sup>13</sup> failed to identify ethnicity

<sup>b</sup>Very low but both studies had evidence of a large treatment effect and dose-response gradient