Coffee Consumption Reduces Mortality in Patients with Acute Myocardial Infarction

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Abstract
Aim: *Acute myocardial infarction (AMI) is the number one cause of death in 2000. Usually, coffee restriction was advised to patients with cardiovascular diseases. Recent studies indicate coffee might have a cardioprotective effect.*
Method*: Systematic search was done on Pubmed and Cochrane. Title and abstract screening were initiated on 12 articles, followed by selection with inclusion and exclusion criteria, and selected one meta-analysis study to be critically appraised.*
Result*: The meta-analysis study appraised resulted with a good score. Reduction in mortality rate was found, and an inverse relationship was concluded between heavy coffee consumption versus no consumption and mortality in acute myocardial infarction patients. RR = 0.54 95% CI [0.45 – 0.65].*
Conclusion*: Coffee consumption and mortality in myocardial infarction patients have an inverse relationship, with the highest risk reduction found in heavy coffee drinkers.*
Keywords *: Acute myocardial infarction, coffee consumption, mortality rate.*

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Konsumsi Kopi Mengurangi Angka Kematian pada Pasien dengan Infark Miokard Akut

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Abstrak
Tujuan: *Infark Miokard Akut adalah penyebab kematian nomor satu pada tahun 2000. Biasanya, pembatasan konsumsi kopi dianjurkan kepada pasien dengan penyakit kardiovaskular. Studi menunjukan bahwa konsumsi kopi dapat mempunyai efek kardioprotektif.*
Metode: *Pencarian sistematis dilakukan dengan pada Pubmed dan Cochrane. Pembacaan judul dan abstrak dilakukan pada 12 artikel, kemudian dilakukan pemilihan dengan kriteria inklusi dan eksklusi, dan didapatkan satu studi meta-analisis. Kemudian dilakukan telaah kritis pada studi tersebut.*
Hasil: *Telaah kritis pada studi meta-analisis didapatkan nilai yang baik. Ditemukan penurunan angka kematian dan hubungan bertolak belakang antara konsumsi kopi dengan angka kematian dibandingkan dengan tanpa konsumsi kopi. RR = 0.54 95% CI [0.45 – 0.65].*
Kesimpulan: *Konsumsi kopi dan angka kematian pada pasien dengan infark miokard akut memiliki hubungan yang berkebalikan, dengan penurunan resiko tertinggi ditemukan pada peminum kopi.*
Kata kunci: *infark miokard akut, konsumsi kopi, angka kematian*

Case Illustration

48-year-old male patient came to the ER with chest pain and shortness of breath 8 hours prior to admission. Chest pain felt like a heavy fullness, with pain radiating to the back. Pain started while the patient was walking with normal pace and pain was not relieved at rest. The pain lasted more than 30 minutes and was accompanied by cold sweats and nausea. Vomiting and loss of consciousness were denied. Shortness of breath felt after the pain. History of heart disease, diabetes mellitus and hypertension were denied. The patient had similar chest pain in the past but was relieved with rest. Upon physical examination, the patient was normoweight. On ECG, ST elevation was found on lead V1-V5. Cardiac marker test revealed CKMB: 74 U/L, Troponin T: 0.19 ng/mL. Patient was diagnosed with ST elevation acute myocardial infarct aterioseptal and was scheduled for PCI. Upon education, patient said that he works as a security personel, and usually drinks up to 4 cups of coffee per day to stay awake. The patient also smokes 1 pack of cigarette per day for the last 30 years.

Introduction

In Indonesia, cardiovascular disease is the number one cause of death in 2000 with 26.3% of deaths.[2] Acute myocardial infarct (AMI) has the highest case fatality rate compared to other cardiovascular diseases with 16.6% in 2002. Killip class is a classification system developed in 1967 to calculate the mortality rate of AMI. Killip class I-IV divide patients with no clinical heart failure signs; patients with rales, crackles, S_3 and elevated jugular venous pressure; patients with acute pulmonary edema; and patients with cardiogenic shock, hypotension, or peripheral vasoconstriction.[3] Killip IV ST-Elevation Myocardial Infarct patients have the highest odds of death among AMI patients with 28 (95% CI 15.24–54.70).[4]

Coffee is the second highest traded commodity in the world, second only to oil. As a common household drink and food, coffee is consumed daily worldwide, and the trend is projected to get higher, as the average age of coffee consumer started to decrease as younger public begin to consume coffee. Coffee contains many amino acids, oils, and active substances. Caffeine, an active substance in coffee is one of the reasons for coffee consumption. People use caffeine to stay awake, alert, and energized. Consumption of more than one cup of coffee is a habit in a lot of people. Like alcohol and

tobacco, caffeine is a psychoactive substance, however, the use of high dose caffeine is unregulated. Energy drinks often includes a high dose of caffeine, and caffeine content in coffee varies between drinks, ranging from 58-259 mg of caffeine per cup of coffee (16 oz).[5]

Common effects of coffee according to the FDA are sleeplessness, agitation, palpitation, increased heart beat frequency, increased blood pressure, dehydration, frequent urination, stomach ache, head ache and dizziness. Caffeine, often in the term of coffee consumption is a common risk factor asked by physicians, especially in cardiovascular and gastrointestinal practice.[6] In this case report, current studies will be systematically searched and reviewed to further investigate whether patients with AMI, with a habit of drinking coffee should be advised against coffee consumption.

Clinical Question

On patients with history of AMI, does habitual coffee consumption compared with

Table 1: Search Strategy

Database	Search Strategy	Hits	Selection Article
Pubmed	Acute myocardial infarction AND coffee AND mortality	11	1
Cochrane Library	Acute myocardial infarction AND coffee AND mortality	1	0

Result

Only one article was reviewed in this case report. The article reviewed is a meta-analysis, which is the highest in the study hierarchy. The critical appraisal was done with the systematic review appraisal sheet. Several criteria were reviewed: validity, applicability, and reliability.

The article reviewed have a clearly stated clinical question, which explore coffee consumption and mortality in patients with history of acute myocardial infarction. The systematic search in the article also covers two databases, although only articles in

coffee restriction increases mortality rate? The aim of the question is to advice the patient on dietary restriction based on recent studies.

Method

Literature search was initiated on Pubmed and Cochrane Library. Keywords used were "acute myocardial infarction AND coffee AND mortality". The exclusion criteria were: studies older than 10 years, healthy sample, animal studies. The inclusion criteria were: all-cause mortality as outcome and meta-analysis.

From the initial 12 articles, nine articles were excluded in the title and abstract screening, six studies were older than 10 years, two used healthy samples, and one was an animal study. Furthermore, two articles were not included, due to not being a meta-analysis. One article by Brown, et al. (2016) was acquired in full text and reviewed.
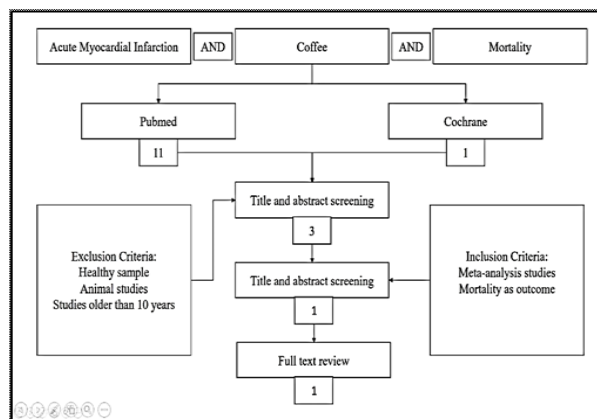

Figure 1: Search Strategy Flow Chart

English were reviewed. Furthermore, only one investigator worked on the data extraction, however, a supervisor was seeing through the data extraction. The articles selected were also appraised for selection bias, confounding and information bias, and the inclusion criteria was determined a priori. Similarity of the result between studies were reviewed, and the studies included were homogenic, with insignificant inconsistency (I2 < 40%; p>0.1).

In the aspect of reliability, the article indicates precise results (narrow 95% CI). Brown, et al. (2016) indicates that there is an inverse correlation between coffee consumption and mortality in acute myocardial infarction patients, with the figures shown an inverted J relationship where all three groups showed a statistically significant risk ratio reduction. Patients with acute myocardial infarction who consumes more than two cups of coffee daily shown the lowest risk ratio compared to light drinkers and non-coffee drinkers (0.69 (95% CI:

0.58-0.83, P<0.001)) and 0.54 (95% CI: 0.45-0.65, P<0.001) respectively).

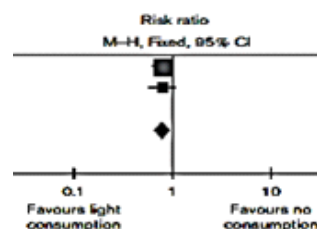In the applicability aspect, Brown, et al. (2016) also uses measurement of coffee in a daily context, in numbers of cups of coffee. The result of this study is applicable in the case scenario.

Table 2.   Critical Apraisal

| Parameter	Brown, et al (2016)
What question did the systematic review address?	Yes, coffee consumption and mortality in patients with history of acute myocardial infarction.
Is it likely that all relevant studies (published and unpublished) were identified?	Yes, coffee consumption and mortality in patients with history of acute myocardial infarction.
Were the criteria used to select articles for inclusion predetermined, clearly stated, and appropriate?	Yes, Inclusion criteria was determined a priori: · be prospective cohort studies in design; · report using hazard ratios, odds ratios, risk ratios and reported them with 95% confidence intervals (CIs); · quantify coffee consumption to enable stratification of consumption into groups; · use all-cause mortality as an outcome; and English language articles.
Were the included studies sufficiently valid?	Yes, the quality of the article was appraised for selection bias, confounding and information bias.
Were studies selected and data extracted by 2 or more individuals?	Only one investigator for data extraction, but with supervision.
Were the results similar from study to study?	Yes, the studies used were homogenic, and the heterogeneity was insignificant.
Conflict of interest	There is no conflict of interest stated.
Clinical Importance	a. Light consumption and no consumption RR = 0.79 95% CI [0.66 – 0.94] b. Heavy consumption and no consumption RR = 0.54 95% CI [0.45 – 0.65] c. Heavy consumption and light consumption RR = 0.69 95% CI [0.58 – 0.83]
How are the results presented?	a. Light consumption and no consumption b. Heavy consumption and no consumption
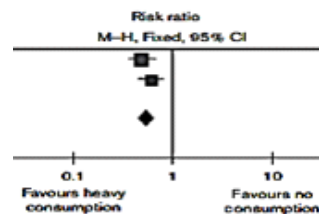
c. Heavy consumption and light consumption
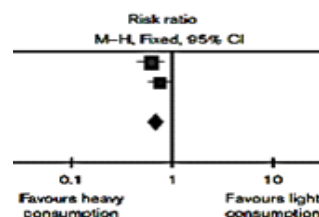
Exploring heterogeneity	a. $x^2 = 0.01$, d.f. = 1 (P = 0.92); I2 = 0%; Q/df <1
	b. $x^2 = 1.15$, d.f. = 1 (P = 0.28); I2 = 13%; Q/df >1
	c. $x^2 = 1.46$, d.f. = 1 (P = 0.23); I2 = 32%; Q/df >1
	There is possible heterogeneity in point b and c, and very unlikely in point a

Discussion

The study Brown, et al. (2016) analyze that there is an inverse association between mortality rate and coffee consumption in patients following acute myocardial infarction, with the best benefit shown in the group with heavy coffee consumption. The mechanism behind the cardioprotective property of coffee is still unknown. However, in a study by Higgins (Higgins and Babu, 2013) it is mentioned that the caffeine affected the cardiovascular system by different means during rest or exercise. At rest, the mechanism of vasodilation is stimulated by increasing intracellular calcium that stimulates endothelial nitric oxide synthase, and direct binding of caffeine to the vascular smooth muscle receptor. Furthermore, caffeine also inhibits adenosine receptors throughout all the vascular circulation including the coronary arteries.[11]

Another proposed mechanism is from the active ingredients in coffee. Although caffeine is the most known and associated active ingredients in coffee, coffee also contain other antioxidants such as chlorogenic acid, flavanoids and melanoidins, metabolites such as caffeine, theobromine and xanthine, and lipid soluble heterocylcic compounds such as furans, maltol and pyrroles. Some of the mechanisms proposed are the improvement of endothelial function in coffee, antioxidant effect and suppresant of hydroxyl radical-generating system and vasodilation from nitric oxide production in the endothelium. However, it was also found that coffee have some contradicting effects such as increase of serum cholesterol levels, homocystein levels, and vasoconstriction by adenosine antagonist effect.[1,6]

Other studies indicate that the vasodilatory and vasoconstriction effect balance may increase the regulation of vascular function.[7] The metabolism of caffeine in the cytochrome P450 1A2 and its genotype can cause a variability in the cardiovascular risk between coffee consumptions. Fast metaboliser often seen with reduction in cardiovascular risk compared to slower metaboliser.[1,6]

To be considered is the other clinical endpoints on the effect of coffee consumption, such as recurrent myocardial infarction and stroke on coffee consumption, and coffee consumption in hypertensive and chronic kidney disease patients. Mostofsky E, et al. (2012) concluded that moderate coffee consumption is inversely associated with heart failure risk, with the highest inverse association was seen for four servings per day.[8] Wijarnpreecha K, et al. (2017) also concluded that there were no significant association between coffee consumption and chronic kidney disease in males.[9] Furthermore, Grosso G, et al. (2017) concluded in his meta analysis that increased coffee consumption is associated with a modest decrease in risk of hypertension.[10]

Further investigation should be considered to answer a more focused question on coffee consumption and its cardiologic effect. Studies currently available includes cohorts and case reports, with a relatively few clinical trials. A therapeutic study could also be considered if the prognostic studies shown significant result.

Conclusion and Recommendation

From the systematic review that have been conducted, it can be concluded that coffee consumption significantly reduces mortality rate in patients with acute myocardial infarction. This can be the result of coffee effect of improving endothelial function, and the effects of many antioxidants in coffee that reduces oxidative stress. Further mechanism is the metabolism of caffeine, in the cytochrome P450 1A2, which genotype have been indicated as a variability cause of cardiovascular risk and coffee consumption. Species and varieties of the coffee plants should also be put into consideration with relation to the dose of caffeine and oils within the drinks. Although the evidence suggested the protective therapeutic effect of coffee, further research with controlled coffee specification is warranted to determine the sought after protective effects of coffee.

The writer recommends allowing coffee consumption, controlled to 1-4 cups a day on a patient following acute myocardial infarction. Especially if the patient is already a long-term coffee drinker.

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