**Original PICO: Rotation 6, Week 1**

please briefly outline the scenario and state your clinical question as concisely and specifically as possible

A 48 years old male PMHx of D2M and asthma came for a routine wellness exam. Patient routine lab value is significant for elevated LDL, TC, and VLDL and low HDL. Pt was diagnosed with Hyperlipidemia, and the medical team decided to initiate a statin therapy. However, the patient shares that last year his cholesterol level was normal, and over the last year he started to consume high quantities of coffee. Patients think lowering the coffee consumption will solve the hyperlipidemia issue and do not want to start medication. Therefore the patient wants to know if the coffee consumption leads to elevated cholesterol level?

**Modified PICO Question:**

In the adult population, does drinking coffee regularly increase serum lipid level?

**PICO search terms:**

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| P | I | C | O |
| Adult | Coffee consumption | no coffee | cholesterolemia |
| Adult Male | Caffeine |  | Elevated serum Cholesterol |
| Adult Female | Unfiltered coffee |  | serum lipids |
|  | Filtered Coffee |  |  |

**Search strategy used: Use at least 3 databases**

**PubMed:**

Coffee effect on Cholesterol (Best Match) – 141

* Filter (Best Match, 10 years, Systematic Reviews, Meta-Analysis, RCT, free full text)-5

Coffee impact on lipid- 83

* Filter (Best Match, 10 years, Systematic Reviews, Meta-Analysis, RCT, free full text)-6

**Cochrane Library:**

Coffee effect on Cholesterol- 100

* Filter (cochrane review)- 1

Coffee impact on lipid- 13

**Trip DataBase**

Coffee effect on Cholesterol-294

**Google Scholar**

Coffee effect on Cholesterol-64,200

* Filter(10 years)- 17,100

**How I selected articles:**

While researching for the articles, I used PubMed and Cochrane to look for systematic review, meta-analysis, RCT which were indexed for Medline and published within the last 10 years. I wanted to access the highest level of evidence that would answer the PICO questions effectively.

**Results found:**

**Article # 1**

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| Citation:  Cai L, Ma D, Zhang Y, Liu Z, Wang P. The effect of coffee consumption on serum lipids: a meta-analysis of randomized controlled trials. *Eur J Clin Nutr*. 2012;66(8):872‐877. doi:10.1038/ejcn.2012.68 |
| Type of article:  Meta-Analysis of Randomized Controlled Trials |
| **Abstract**  **Background/objectives:**Numbers of epidemiological studies assessing coffee consumption and serum lipids have yielded inconsistent results. We aimed to evaluate the effects of coffee intake on serum lipids.  **Subjects/methods:**We searched several English and Chinese electronic databases up to September 2011 for randomized controlled trials of coffee on serum lipids. Weighted mean effect size was calculated for net changes in serum lipids by using random-effect models or fixed-effect models. Subgroup and meta-regression analyses were conducted to explore possible explanations for heterogeneity among trials.  **Results:**Twelve studies conducted in Western countries with a total of 1017 subjects were identified. Meta-analyses showed, on average, drinking coffee for 45 days was associated with an increase of 8.1 mg/dl (95% confidence interval (CI): 4.5, 11.6; P<0.001) for total cholesterol (TC), 5.4 mg/dl (95% CI: 1.4, 9.5; P=0.009) for low-density lipoprotein cholesterol (LDL-C) and 12.6 mg/dl (95% CI: 3.5, 12.6; P=0.007) for triglyceride (TG). The increase in TC were greater in trials using unfiltered coffee and caffeinated coffee as the treatment group. Those who had hyperlipidemia were more sensitive to the cholesterol-raising effect of coffee. Meta-regression analysis revealed a positive dose-response relation between coffee intake and TC, LDL-C and TG.  **Conclusion:**The intake of coffee especially unfiltered coffee is contributed significantly to the increase in TC, LDL-C and TG, and the changes were related to the level of intake. Studies of coffee intake on serum lipids in Asian populations should be performed. |
| Article: |

**Article # 2**

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| Citation:  Penson P, Serban MC, Ursoniu S, Banach M; Lipid and Blood Pressure Meta-analysis Collaboration (LBPMC) Group. Does coffee consumption alter plasma lipoprotein(a) concentrations? A systematic review. *Crit Rev Food Sci Nutr*. 2018;58(10):1706‐1714. doi:10.1080/10408398.2016.1272045 |
| Type of article:   A Systematic Review |
| Abstract  Coffee consumption alters plasma lipid and cholesterol concentrations, however, its effects on lipoprotein(a) (Lp(a)) have received little study. The aim of this PRISMA compliant systematic review was to examine the role of coffee on serum Lp(a). This study was prospectively registered (PROSPERO 2015:CRD42015032335). PubMed, Scopus, Web of Science and Cochrane Central were searched from inception until 9th January 2016 to detect trials and epidemiological studies investigating the impact of coffee on serum Lp(a) concentrations in humans. We identified six relevant publications describing nine experimental trials of various designs. There were a total of 640 participants across all studies and experimental groups. In short-term controlled studies, consumption of coffee, or coffee diterpenes was associated with either a reduction in serum Lp(a) of ≤11 mg/dL (6 trials, 275 participants), or no effect (2 trials, 56 participants). Conversely, one cross-sectional study with 309 participants showed serum Lp(a) was elevated in chronic consumers of boiled coffee who had a median Lp(a) of 13.0 mg/dL (range 0-130) compared with consumers of filtered coffee who had median Lp(a) 7.9 mg/dL (range 0-144). The effect of coffee on Lp(a) is complex and may follow a biphasic time-course. The type of coffee and the method of preparation appear to be important to determining the effect on Lp(a).  **Keywords:**Cafestol; coffee; diterpenes; kahweol; lipoprotein(a). |
| Article: |

**Article # 3**

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| Citation:  Agudelo-Ochoa GM, Pulgarín-Zapata IC, Velásquez-Rodriguez CM, et al. Coffee Consumption Increases the Antioxidant Capacity of Plasma and Has No Effect on the Lipid Profile or Vascular Function in Healthy Adults in a Randomized Controlled Trial. *J Nutr*. 2016;146(3):524‐531. doi:10.3945/jn.115.224774 |
| Type of article:   a Randomized Controlled Trial |
| Abstract  **Background:**Coffee, a source of antioxidants, has controversial effects on cardiovascular health.  **Objective:**We evaluated the bioavailability of chlorogenic acids (CGAs) in 2 coffees and the effects of their consumption on the plasma antioxidant capacity (AC), the serum lipid profile, and the vascular function in healthy adults.  **Methods:**Thirty-eight men and 37 women with a mean ± SD age of 38.5 ± 9 y and body mass index of 24.1 ± 2.6 kg/m(2) were randomly assigned to 3 groups: a control group that did not consume coffee or a placebo and 2 groups that consumed 400 mL coffee/d for 8 wk containing a medium (MCCGA; 420 mg) or high (HCCGA; 780 mg) CGA content. Both were low in diterpenes (0.83 mg/d) and caffeine (193 mg/d). Plasma caffeic and ferulic acid concentrations were measured by GC, and the plasma AC was evaluated with use of the ferric-reducing antioxidant power method. The serum lipid profile, nitric oxide (NO) plasma metabolites, vascular endothelial function (flow-mediated dilation; FMD), and blood pressure (BP) were evaluated.  **Results:**After coffee consumption (1 h and 8 wk), caffeic and ferulic acid concentrations increased in the coffee-drinking groups, although the values of the 2 groups were significantly different (P < 0.001); caffeic and ferulic acid concentrations were undetectable in the control group. At 1 h after consumption, the plasma AC in the control group was significantly lower than the baseline value (-2%) and significantly increased in the MCCGA (6%) and HCCGA (5%) groups (P < 0.05). After 8 wk, no significant differences in the lipid, FMD, BP, or NO plasma metabolite values were observed between the groups.  **Conclusions:**Both coffees, which contained CGAs and were low in diterpenes and caffeine, provided bioavailable CGAs and had a positive acute effect on the plasma AC in healthy adults and no effect on blood lipids or vascular function. The group that did not drink coffee showed no improvement in serum lipid profile, FMD, BP, or NO plasma metabolites. This trial was registered at registroclinico.sld.cu as RPCEC00000168.  **Keywords:**caffeine; cardiovascular disease; chlorogenic acids; cholesterol; diterpenes; flow-mediated dilation; oxidative stress; phenolic acids. |
| Article: |

**Article # 4**

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| Citation:  Nystad T, Melhus M, Brustad M, Lund E. The effect of coffee consumption on serum total cholesterol in the Sami and Norwegian populations. *Public Health Nutr*. 2010;13(11):1818-1825. doi:10.1017/S1368980010000376 |
| Type of article:   A cross-sectional study |
| Objective: To assess coffee consumption in the Sami and Norwegian populations and to investigate the impact of unfiltered boiled coffee consumption on serum cholesterol concentrations. Design: A cross-sectional study. Information was collected by self-administrated questionnaires and total serum cholesterol was analysed. Participants were divided into three ethnic groups: Sami I (Sami used as home language in the last three generations), Sami II (at least one Sami identity marker) and Norwegian. Setting: In an area with Sami, Kven/Finnish and Norwegian populations, the SAMINOR study, 2003–2004. Subjects: A total of 5647 men and 6347 women aged 36–79 years. Results: More than 90 % of the study populations were coffee drinkers. Only 22 % were unfiltered coffee consumers. Sami I had the highest proportion of participants who consumed nine or more cups of unfiltered coffee per day, although the number of participants was limited. Total coffee consumption was associated with increased total cholesterol for men (P , 0?01) and women (P , 0?0001). For those who drank only unfiltered coffee, a significant association was found only in Norwegian men, adjusted for physical activity in leisure time, BMI and smoking habits (P , 0?001). From the lowest (less than five cups) to the highest (nine or more cups) unfiltered coffee consumption category, the mean total cholesterol levels increased by 0?29 mmol/l in Norwegian men. Conclusions: Unfiltered coffee consumption was lower in the present study compared to previous reports. In general, total coffee consumption was positively associated with total cholesterol levels. However, for unfiltered coffee consumption, an association was found only in Norwegian men. |
| Article: |

**Article # 5**

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| Citation: Sun Ha Jee, Jiang He, Lawrence J. Appel, Paul K. Whelton, II Suh, Michael J. Klag, Coffee Consumption and Serum Lipids: A Meta-Analysis of Randomized Controlled Clinical Trials, *American Journal of Epidemiology*, Volume 153, Issue 4, 15 February 2001, Pages 353–362, <https://doi.org/10.1093/aje/153.4.353> |
| Type of article:    A Meta-Analysis of Randomized Controlled Clinical Trials |
| Coffee drinking has been associated with increased serum cholesterol levels in some, but not all, studies. A Medline search of the English-language literature published prior to December 1998, a bibliography review, and consultations with experts were performed to identify 14 published trials of coffee consumption. Information was abstracted independently by two reviewers using a standardized protocol. With a random-effects model, treatment effects were estimated by pooling results from individual trials after weighting the results by the inverse of total variance. A dose-response relation between coffee consumption and both total cholesterol and LDL cholesterol was identified (p < 0.01). Increases in serum lipids were greater in studies of patients with hyperlipidemia and in trials of caffeinated or boiled coffee. Trials using filtered coffee demonstrated very little increase in serum cholesterol. Consumption of unfiltered, but not filtered, coffee increases serum levels of total and LDL cholesterol. |
| Article: <https://academic.oup.com/aje/article/153/4/353/129046> |

**Summary of the Evidence**:

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| Author (Date) | Level of Evidence | Sample/Setting  (# of subjects/ studies, cohort definition etc. ) | Outcome(s) studied | Key Findings | Limitations and Biases |
| Cai L, Ma D, Zhang Y, Liu Z, Wang P | Meta-Analysis of Randomized Controlled Trials | PubMed, Cochrane Controlled Trials Register, EMBASE , were used to search articles in English and Chinese **Inclusion criteria**:   1. subjects ingested coffee for at least 7 days 2. the RCTs included a parallel control group 3. TC, LDL-C, HDL-C or TG was used as an index of lipid profile.   **Exclusion Criteria**   1. nonrandomized treatment allocation 2. a lack of concurrent control group; 3. insufficient data to calculate the net change in serum lipids and their variances.   12 studies were included in this meta-analysis with a total of 1017 subjects.  Out of the 12 studies only 3 analyzed the effect of decaffeinated coffee while rest analyzed Caffeine coffee  Intervention group= Unfiltered coffee, filtered coffee, boiled coffee  The control group received no coffee or tea  The duration of treatment varied widely, ranging from 14 to 79 days (average, 45 days). | Investigate the effects of coffee intake on serum lipids ( TC, LDL-C, HDL-C and TG)  clarify the active factors of coffee  Evaluate the effect of coffee oils, such as cafestol and kahweol on serum lipids ( TC, LDL-C, HDL-C and TG)  . | This meta-analysis showed a significant increase in TC, LDL-C and TG, but not in HDL-C, during coffee interventions  All 12 RCT shows a significant effect of coffee consumption on TC and an increase of 8.1 mg/dl was noted(95% CI: 4.5, 11.6; Po0.001)  The effect of coffee on lipid profile was more pronounced among older men who drank boiled caffeinated coffee in great quality  caffeine coffee had significant effects on LDL-C, TC and TG but decaffeinated coffee had not.  Significant positive associations between coffee consumption and the net change in TC, LDL-C and TG.  Effect for every cup/day increment in coffee intake was 3.74 mg/dl in TC, 3.38 mg/dl in LDL-C and 6.56 mg/dl in TG.  This meta-analysis results suggested that the intake of coffee, especially unfiltered coffee, contributed significantly to the increase in TC, LDL-C and TG.  In this meta-analysis, the summary effect for every cup/day increment in coffee intake was 3.74 mg/dl in TC, 3.38 mg/dl in LDL-C and 6.56 mg/dl in TG. | This meta-analysis excluded trials that use additives in coffee which can be a confounding factor in increasing serum lipid  Sex might modifiy the effect of coffee on lipids for example the effect of coffee on lipids was significantly larger in trials that included both men and women, compared with trials that included only men.  Sex differences in lipid profiles in response to coffee have not been particularly investigated so further studies should be conducted which specifically enroll women.  However, after filling in the missing study identified by the trim and fill method and recalculating the combined value of TC, we found that coffee drinking increased TC by 7.8 mg/dl, which means that the publication bias had little effect on the results |
| Peter Penson Maria-Corina Serban, , Sorin Ursoniu , Maciej Banach | A systematic Review | Inclusion Criteria:   1. Controlled trials or crossover trials which reported serum Lp(a) concentration at the baseline and completion and included coffee consumption 2. Prospective cohort studies or other epidemiological studies which reported serum lipoprotein(a) concentrations and coffee consumption   Exclusion Criteria   1. not conducted in humans 2. did not enable to obtain sufficient information regarding Lp(a)   After searching multiple platforms, 945 articles were selected to be reviewed and out of that only 6 articles meet the  requirement to be included in this systematic review  total of 640 participants across all studies and experimental groups  Four trials groups:  Trial A: run for 4 weeks where participants were randomized to drink 0.9 l/day (5 cups) filtered coffee or cafetiere coffee  Trial B, 32 participants were randomised to receive 3g/day of either placebo oil (a 3:2 w/w mixture of sunflower oil and palm oil) or coffee oil which gave a daily dose of 85 mg of cafestol and 103 mg of kahweol  Trial C: 36 participants were randomised to receive 2g/day of placebo oil, coffee oil (equivalent to a daily dose of 57 mg cafestol and 69 mg kahweol), or coffee oil that had been stripped of cafestol and kahweol | examined the relationship between the consumption of coffee (or extracts of coffee) upon plasma concentrations of Lp(a).  Trial A which was designed to compare the effects on Lp(a) of diterpene-rich unfiltered coffee with filtered coffee | Trial A result shows: Cafetiere coffee (38 mg/day cafestol and 33mg/day kahweol) produced a fall in Lp(a) which was maximal at 8 weeks (1.5 mg/dL) and which stabilized at around 0.5 mg/dL between weeks 12 and 24  Trial B result shows: Lp(a) concentrations were lower by a median of 5.3 mg/dL in the coffee oil group than in the placebo oil group  Trial C result shows:Coffee oil reduced LP(a) concentrations by 3.1 mg/dL, an effect that was not seen with placebo oil or stripped oil  The effects of coffee consumption on plasma lipoprotein depends on the source of the coffee, the method of preparation, the dose and the duration of consumption.  In short term coffee consumption, the lipoprotein decrease but chronic coffee consumption increases serum lipoprotein  No clinical recommendations can be made based upon the current evidence  This systematic review found diterpenes lowers Lp(a) after consuming coffee for short period of time but it the long term effect need to be studied also decrease Lp(a) does not directly correlates with decrease in TC and LDH | Majority of the trials in this systematic review are not placebo controlled which is a systemic bias for this research so more widespread reporting of serum lipoprotein clinical trials need to be conducted.  The number of participants in trials was generally very small.  coffee came from a variety of sources and multiple methods of preparation were employed. Therefore the results are hard to assimilate, and it was not possible to perform a meta-analysis  there is a lack of data regarding decaffeinated coffee and coffee produced by automated coffee machines. |
| Gloria M Agudelo-Ochoa, Isabel C Pulgar´ın-Zapata,Claudia M Velasquez-Rodriguez, ´ Mauricio Duque-Ram´ırez,Mauricio Naranjo-Cano, Monica M Quintero-Ortiz, ´ Oscar J Lara-Guzman, ´ and Katalina Mun˜ oz-Durango | a Randomized Controlled Trial | **inclusion criteria**: aged 20–60 y; BMI 18.5-29.9; regular coffee drinker (at least 3 cups/d; 1 cup = ;100 mL); nonsmoker; physical activity of <10 h/wk; no history and/or diagnosis of chronic disease; not currently consuming medication (lipid-lowering drugs, antioxidant dietary supplements, anticonvulsants, anti-inflammatory steroids, hypnotics)  75 participants (38 men & 37 female) met the inclusion criteria; they were divided into three groups: control group (no coffee consumption, no placebo) and 2 groups that drank 1 of 2 types of coffee (400 mL/d) for 8 wk that differed with respect to CGA content.  Control group had 25 participants, 25 participants is a medium CGA content of 420 mg (MCCGA) or 25 participants in high CGA content (HCCGA)  During the intervention, all participants avoided consuming beverages with caffeine as well as beverages or foods that were naturally high in antioxidants | evaluated the bioavailability of chlorogenic acids (CGAs)/CGA metabolites (caffeic and ferulic acids) in 2 types of filtered coffee  This study evaluates the effects of the CGAs on the plasma AC, lipid profiles, and vascular function in healthy adults | There was not a significant time 3 intervention interaction effect for the lipid profile, FMD, or NO plasma metabolites (P > 0.05)  The result shows unfiltered coffee have consistently shown the negative effect plasma Total cholesterol, beverages prepared with filters is not a major risk for increased Total cholesterol  Finally, it is important to note that this study showed that ceasing to drink coffee did not improve serum lipid profile, FMD, BP, or NO plasma metabolites. | A limitation of this study was that other CGA metabolites as well as other components responsible for coffees total AC were not measured. |
| Tove Nystad\*, Marita Melhus, Magritt Brustad and Eiliv Lund | A cross-sectional study | total of 5647 men and 6347 women aged 36–79 years.  Participants were divided into three ethnic groups: Sami I (Sami used as home language in the last three generations), Sami II (at least one Sami identity marker) and Norwegian.  Sami I had the highest proportion of participants who consumed nine or more cups of unfiltered coffee per day | To assess coffee consumption in the Sami and Norwegian populations and to investigate the impact of unfiltered boiled coffee consumption on serum cholesterol concentrations. | Sami I group: 9 cups or more consumption of unfiltered coffee was associated with increased total cholesterol for men (*P* < 0·01) and women (*P* < 0·0001)  From the lowest (less than five cups) to the highest (nine or more cups) unfiltered coffee consumption category, the mean total cholesterol levels increased by 0·29 mmol/l in Norwegian men.  In general, total coffee consumption was positively associated with total cholesterol levels. However, for unfiltered coffee consumption, an association was found only in Norwegian men. | The Sami I group was older than both the Norwegian and the Sami II sub-populations. Sami I had a more sedentary activity in leisure time, higher proportions of current smokers and a higher level of mean BM |
| Sun Ha Jee, Jiang He, Lawrence J. Appel, Paul K. Whelton, II Suh, Michael J. Klag | A Meta-Analysis of Randomized Controlled Clinical Trials | Inclusion Criteria   1. results from human experimentation with random allocation of participant 2. used coffee drinking as the active treatment intervention 3. included no intervention difference between the active treatment and control groups other than coffee consumption 4. provided data to calculate the differences in serum total cholesterol change and between the active and control treatments and the corresponding variances of this difference.   14 studies were included in this meta analysis  All of the trials were conducted on adults, with a range of mean ages of 26–49 years | This meta analysis is going to investigate the effect of unfilter coffee effect on cholesterol | Drinking six cups of coffee was significantly associated with an increase in total cholesterol (11.8 mg/dl), LDL cholesterol (6.5 mg/dl), and triglyceride (5.9 mg/dl), but not HDL cholesterol (0.2 mg/dl) levels.  The effect of coffee drinking on total cholesterol was mediated almost solely through its effect on LDL cholesterol and was more pronounced in trials in which the participants drank boiled coffee, had hyperlipidemia, drank more coffee, and were, on average, older.  filtered coffee demonstrated only minimal effects of coffee on serum cholesterol levels. | One of the limitation of the study is that it only includes articles published in the English language  The lack of resources prevented the author from including articles published in other languages. |

**Conclusion(s):**

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| **Article** | **Conclusions** |
| **Article #1** | Based on this meta-analysis, **coffee can significantly increase the total cholesterol and low-density lipoproteins as all 12 studies noted a increase of 8.1 mg/dl cholesterol** **(95% CI: 4.5, 11.6; Po0.001**).The increase in TC, LDL-C and TG were more pronounced in studies with coffee intake X6 cups/day. Also,The effect of coffee on lipid profile was more pronounced **among older men who drank boiled caffeinated coffee** in great quality. Caffeinated, unfiltered, and boiled coffee have significant impact on LDL-C, TC and TG but decaffeinated coffee does not impact lipid profile. This meta analysis conclude that if an individual drinks caffeinated coffee then for every cup/ day the TC can increase 3.74 mg/dl in TC, LDL-C can increase 3.38 mg/dl and TG can increase 6.56 mg/dl. Furthermore, the effect of coffee drinking on lipids was more prominent with a shorter intervention duration (8 weeks). |
| **Article #2** | Based on the Systematic review, the effects of coffee consumption on plasma lipoprotein depends on the source of the coffee, the method of preparation, the dose and the duration of consumption. Short term coffee consumption (4 weeks) decreases the lipoprotein but chronic coffee consumption increases serum lipoprotein. Also,  Lp(a) is an independent risk-factor for stroke according to multiple meta-analyses but decrease in Lp(a) does not mean that coffee does not affect the lipid profile. |
| **Article #3** | This RCT evaluated the bioavailability of chlorogenic acids with two types of coffee which were low in diterpenes and caffeine therefore it had a positive acute effect on the plasma AC in healthy adults and no effect on blood lipids or vascular function. The author notes thattwo diterpenes in coffee oil, cafestol and kahweol, are the main substances that have a cholesterol-raising effect.The diterpenes can be easily removed through filter so this RCT included filtered coffee to see the effect of chlorogenic acids in lipid profile. Therefore, the **RCT also suggests that unfiltered coffee or coffee high in diterpenes has a major risk factor for increasing cholesterol.** |
| **Article 4** | According to this cross sectional study, **unfiltered coffee has a significant impact on the total cholesterol leve**l. The author acknowledges that the use of unfiltered coffee is lower in the present days but Scandinavian unfiltered coffee, Turkish coffee and French press (cafetiere) coffee are high in diterpenes which is positively associated with total cholesterol levels. |
| **Article 5** | According to this meta analysis, **drinking six cups of boiled/ unfiltered coffee can significantly increase in total cholesterol (11.8 mg/dl), LDL cholesterol (6.5 mg/dl), and triglyceride (5.9 mg/dl).** The author explains that unfiltered coffee has a high amount of coffee oil, cafestol and kahweol, which are primarily responsible for increasing lipid. Also, coffee oil increases the synthesis of cholesterol by decreasing excretion of bile acids and neutral sterols. Additionally ,boiled coffee has a higher concentration of coffee oils so avoiding boiling and unfilter can remove cholesterol-raising fraction from the coffee. |

**Overarching Conclusion:**

Drinking 6 cups or more of unfiltered/boiled coffee a day can significantly increase LDL-C, TC and TG.

**Clinical “bottom line”**

Coffee is one of the most commonly consumed beverages worldwide, and it is very popular in the western world. Based on the two meta-analysis, systematic review, RCT and cross sectional study, Unfiltered/boiled coffee consumption has a profound effect on serum lipid level. Since meta-analysis and systematic review agree on the significant effect of coffee on TC and LDH, I would inform the patient that “ great quantity (6 cups or more a day) of unfiltered coffee/ boiled coffee consumption could have led to hyperlipidemia”. Most people in the United States do not drink unfiltered coffee, so most likely the hyperlipidemia in this patient is not caused by coffee consumption. However, all the articles’ authors agree that there are other factors such as method of preparation, quantity of coffee and consumption habit will determine the effect of coffee on serum lipid. Furthermore, other lifestyles can also enhance the effect of coffee. For example, coffee consumption combined with smoking is known to increase serum lipid levels. So I would inform the patient that multiple factors can cause hyperlipidemia, and coffee could be one of the causes. Furthermore, the RCT result reveals that cessation of coffee does not lower lipid level therefore, I would recommend initiating statin therapy because only coffee cessation is not going to improve this lipid level. Additionally, the patient can be advised to decrease coffee consumption along with taking the medication because statin has great benefit in reducing cardiovascular risk in the long term.

**Weight of the Evidence:**

1. Cai L, Ma D, Zhang Y, Liu Z, Wang P (Article#1) will be weighted as the highest because it is a meta-analysis that addresses my PICO question specifically and effectively. Also, this article is medline indexed, and it was published within the last 10 years. This article analyzed 992 articles before selecting 12 articles that include 1017 subjects. Most of the RCT included in this meta analysis were conducted in the western countries, which means the data is transferable to answer the patient question.
2. Penson P, Serban MC, Ursinus, Banach M (Article#2) will be weighted as second highest because it is a systematic review that was published within the last 10 years in a reputable journal that’s indexed for Medline. This study included 640 participants to analyze the effect coffee has on plasma lipoprotein. This article is relevant to my PICO because it’s comparing the effect of coffee on serum lipid level.
3. Agudelo-Ochoa GM, Pulgarín-Zapata IC, Velásquez-Rodriguez CM, et a (Article #3) will be weighted as third it is a RCT that was published in 2016. This RCT is relevant to answer my PICO question. This article looked at the effect of coffee in the plasma antioxidant capacity (AC), **the serum lipid profile,** and the vascular function in healthy adults. Based on this article, coffee does not affect the serum lipid level. Furthermore, this RCT answers the patient's question that ceasing to drink coffee does not improve serum lipid profile, so the patient will benefit more with starting the statin medication.
4. Sun Ha Jee, Jiang He, Lawrence J. Appel, Paul K. Whelton, II Suh, Michael J. Klag (Article #5) will be weighted as fourth because it is a meta-analysis of randomized clinical trialsthat investigated the effect of coffee on the lipid profile. I am aware that this article was published like 20 years ago but I believe the integrity of the information is still relevant to my pico question. This meta analysis points out that boiled coffee and caffeinated coffee consumption associated with increased total and low density lipoprotein cholesterol concentrations. This Meta-analysis directly answers my Pico questions.
5. Tove Nystad, Marita Melhus, Magritt Brustad and Eiliv Lund (Article #4) will be weighed last because it is cross sectional studies. However, this article was published within the last 10 years and it answers the PICO question efficiently. This study investigated the effect of coffee on lipid profile specifically for the Norwegian population. The subject group is not from western population but the intervention of unfiltered/boiling coffee is still utilized in the western culture so the data is still relevant to answer my PICO question. Furthermore, this study is a cross sectional research but the research method is valid and reliable.

**Magnitude of any effects**

The two meta-analyses, systematic review, RCT and cross sectional studies agree that unfiltered or boiled coffee in great quality (6 cups or more a day) can increase the TC, LDH and TG which can increase the cardiovascular risk.

**Clinical significance (not just statistical significance)**

Based on the highest level of evidence, caffeinated and boiled coffee lead to significant increase in the level of TC, LDH and TG. Most research attributes the increased lipid profile due to diterpene compounds (cafestol and kahweol) that are present in coffee so if an individual drinks coffee that removes the diterpene compounds then they can easily avoid the lipid effect. Furthermore, other life factors such as smoking, sedentary lifestyle, lack of exercise, unhealthy food that could lead to increased lipid profile, so coffee can’t be blamed as a only culprit for increasing cholesterol level.

**Any other considerations important in weighing this evidence to guide practice**

There are multiple factors such as types of coffee (caffeinated, decaffeinated, boiled, filtered, unfiltered, instant) that could play a role in increasing the cholesterol level. Most studies included in this PICO did not evaluate the effect of decaffeinated coffee on lipid profile so further studies need to be conducted regarding the effect of decaffeinated coffee. Additionally, coffee additives such as cream and milk, might be responsible for the association between coffee consumption and higher serum cholesterol levels so more RCT needs to be conducted where these coffee additives are limited. Overall, recent meta-analyses with a large subject need to be conducted where the types of coffee and the amount of coffee consumption is specified to establish confident clinical recommendation.