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STEATOTIC LIVER DISEASE: THE IMPACT OF TEA AND COFFEE CONSUMPTION. LITERATURE REVIEW

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Abstract

Background. Globally, nonalcoholic fatty liver disease (NAFLD) affects more than one quarter of the adult population. It is characterized by excessive hepatic fat accumulation, associated with insulin resistance and defined as the histological presence of steatosis in >5% hepatocytes.

Objective. The purpose of this review is to study the influence of tea and coffee consumption on liver function in NAFLD.

Search Strategy. The following databases were used: Google Scholar, PubMed, and Scopus. We included articles written in English. The search keywords in PubMed are liver, coffee/tea, NAFLD. We included articles in the review published between 2017 and 2025, mostly at evidence levels A and B.

Research Results. According to numerous studies, regular coffee drinkers are far less likely to develop NAFLD, and those who have already been diagnosed with NAFLD are much less likely to develop liver fibrosis. Coffee drinkers who consume ≥3 cups/day of coffee are significantly associated with a reduced risk of liver-related hospitalizations. Moderate coffee consumption (three to five cups per day) is acceptable as part of a healthy diet.

Studies show that various types of tea protect hepatocytes from lipid toxicity by effectively improving the imbalanced lipid metabolism in the serum and liver tissue. The studies were conducted primarily in mice and showed some benefits related to liver function.

Conclusion. Moderate coffee consumption (3 cups per day) is recommended for patients with NAFLD to prevent the development of liver fibrosis. More research needs to be conducted to evaluate the effects of tea on people soon.

Keywords. *liver, coffee/tea, nonalcoholic fatty liver disease, Liver steatosis/fibrosis*

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Резюме

СТЕАТОТИЧЕСКАЯ БОЛЕЗНЬ ПЕЧЕНИ: ВЛИЯНИЕ ПОТРЕБЛЕНИЯ ЧАЯ И КОФЕ. ОБЗОР ЛИТЕРАТУРЫ

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Введение. Во всем мире неалкогольная жировая болезнь печени (НАЖБП) поражает более четверти взрослого населения. Она характеризуется избыточным накоплением жира в печени, связанным с инсулинорезистентностью и определяемым как гистологическое наличие стеатоза более чем в 5% гепатоцитов.

Целью данного обзора является изучение влияния потребления чая и кофе на функции печени при НАЖБП.

Стратегия поиска. При поиске статей на английском языке использовались следующие базы данных: Google Scholar, PubMed и Scopus. Ключевые слова для поиска в PubMed: печень кофе/чай, НАЖБП. В обзор мы включили статьи, опубликованные с 2017 по 2025 год, в основном с уровнем доказательности А,В.

Результаты исследований. Согласно многочисленным исследованиям, у потребителей, регулярно употребляющих кофе, гораздо меньше шансов заболеть НАЖБП, а у тех, кому уже поставили диагноз НАЖБП, гораздо меньше шансов заболеть фиброзом печени. У потребителей кофе, которые употребляют ≥3 чашек кофе в день, значительно снижен риск госпитализаций, связанных с заболеваниями печени. Умеренное потребление кофе (от трех до пяти чашек в день) приемлемо как часть здоровой диеты.

Исследования показывают, что различные виды чая защищают гепатоциты от липидной токсичности, эффективно улучшая несбалансированный липидный обмен веществ в сыворотке и тканях печени. Исследования проводились в основном на мышах и показали некоторые преимущества, связанные с функциями печени.

Заключение. Пациентам с НАЖБП рекомендуется умеренное потребление кофе (3 чашки в день) для предотвращения развития фиброза печени. Для оценки влияния чая на функцию печени необходимо проводить исследования среди людей в ближайшем будущем.

Ключевые слова. *печень, кофе/чай, неалкогольная жировая болезнь печени, стеатоз/фиброз печени.*

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Түйіндеме

БАУЫРДЫҢ СТЕАТОЗДЫҚ АУРУЫ: ШАЙ МЕН КОФЕ ТҰТЫНУДЫҢ ӘСЕРІ. ӘДЕБИЕТТІК ШОЛУ.

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Кіріспе. Бүкіл әлемде алкогольды емес майлы бауыр ауруы (АЕМБА) ересек тұрғындардың төрттен бірінен астамына әсер етеді. Ол инсулинге төзімділікпен байланысты бауыр майының шамадан тыс жиналуымен сипатталады және гепатоциттердің >5%-да стеатоздың гистологиялық болуы ретінде анықталады.

Мақсаты. Бұл шолудың мақсаты шай мен кофені тұтынудың АЕМБА бауыр функциясына әсерін зерттеу.

Іздеу стратегиясы. Біз ағылшын тіліндегі жазылған мақалаларды іздеген кезде келесі дерекқорларды қолдандық: Google Scholar, PubMed және Scopus. PubMed-те іздеу кілт сөздері - бауыр, кофе/шай, АЕМБА. Біз 2017 жылдан 2025 жылға дейінгі жарияланған мақалаларды шолуға қостық, көбінесе A, B дәлелдер деңгейінде.

Зерттеу нәтижелері. Көптеген зерттеулерге сәйкес, тұрақты кофе ішетіндердің АЕМБА-ын дамыту ықтималдығы әлдеқайда төмен, ал АЕМБА диагнозы қойылған адамдарда бауыр фиброзының даму ықтималдығы әлдеқайда аз. Күніне ≥3 шыныаяқ кофе тұтынатын кофе ішетін адамдар бауырға байланысты ауруханаға жатқызу қаупінің төмендеуімен айтарлықтай байланысты. Кофенің қалыпты тұтынуы (тәулігіне үш-бес кесе) дұрыс тамақтану диетаның бөлігі ретінде қабылданады.

Көптеген зерттеулер көрсеткендей, шайдың әртүрлі түрлері сарысу мен бауыр тініндегі теңгерімсіз липидтер алмасуын тиімді жақсарту арқылы гепатоциттерді липидтердің уыттылығынан қорғайды. Зерттеулер негізінен тышқандар арасында жүргізілді және бауыр функциясына қатысты кейбір артықшылықтарды көрсетті.

Қорытынды. Бауыр фиброзының дамуын болдырмау үшін АЕМБА бар науқастарға кофені қалыпты тұтыну (тәулігіне 3 кесе) ұсынылады. Жақын болашақта шайдың адамдарға әсерін бағалау үшін зерттеулер жүргізу қажет.

Түйінді сөздер. *бауыр, кофе/шай, алкогольды емес майлы бауыр ауруы, бауыр стеатозы/фиброз.*

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Introduction

Annually, 2 million people die from liver disease, with 1 million due to complications of cirrhosis [1] caused mostly by excessive alcohol consumption. But cirrhosis could be induced by the absence of excessive alcohol consumption in case of nonalcoholic fatty liver disease (NAFLD) [37].

Globally, NAFLD affects more than one quarter of the adult population [52]. It is characterized by excessive hepatic fat accumulation, associated with insulin resistance and defined as the histological presence of steatosis in >5% hepatocytes [17].

The annual incidence of NAFLD is approximately two new cases/100 patients per year [47]. This hazard rises mostly due to the obesity and diabetes epidemics, which lead to a heavy clinical and economic burden on society [70]. The global prevalence of NAFLD is approximately 25%, ranging from 13% in Africa to 42% in Southeast Asia [20]. Asia is a growing epicentre for industrialisation, and changing lifestyles and diet that have contributed to the obesity and NAFLD epidemic in Asia [28]. NAFLD severity is correlated with obesity, but interestingly, non-obese persons can also have NAFLD, particularly in certain Asian countries [50]. The incidence of NAFLD was higher in males vs. females (P<0.0001) in Asia [58]. Women exhibit a reduced susceptibility to NAFLD compared to men, at least until menopause, after which the prevalence of NAFLD becomes comparable across the sexes, indicating the protective influence of estrogens [4].

Patients with NAFLD face an elevated risk of all-cause and liver-related mortality, with this risk escalating exponentially as the fibrosis stage progresses from stage 0 to stage 4 [7].

In the US, the prevalence of NAFLD was about 30% among the population aged ≥15 years in 2015 [11]. Annual direct medical costs for NAFLD are estimated at $101 billion in the United States €35 billion in Europe [25].

It has been demonstrated that coffee consumption improves liver health, including hepatitis B and C, NAFLD, and alcoholic liver disease [5]. slowing the progression of fibrosis. Moreover, coffee consumption could be a protective factor against NAFLD and liver fibrosis [23]. Tea intake is causally associated with a decreased risk of NAFLD [32].

Objective. The purpose of this review is to study the influence of tea and coffee consumption on liver function in NAFLD.

Search Strategy. The following databases were used: Google Scholar, PubMed, and Scopus. We included articles written in English. The search keywords in PubMed are liver, coffee/tea, and NAFLD/ MAFLD.

Inclusion criteria. We included articles in the review published between 2017 and 2025, mostly at evidence levels A and B. We evaluated the effects of coffee and tea consumption on the progression of NAFLD/MAFLD. We paid attention to the following issues with the PICOS model: number of patients, cups per day, many comparisons, and effects on liver functions.

Exclusion criteria. We excluded articles published before 2016. Also, we excluded expert opinion in the form of short communications, promotional articles.

Research Study.

Redefining NAFLD to MAFLD. NAFLD is a major public health crisis [49] of the 21st century [41] and one of the main reasons for liver transplantation [3]. It is currently estimated that 25% of people worldwide suffer from NAFLD [66] up to one billion people worldwide [34].

NAFLD refers to a clinicopathological syndrome characterized by hepatic steatosis [41] via triglyceride accumulation in hepatocytes [29], with a condition of fatty infiltration in the liver [27] in the absence of excessive alcohol consumption [40]. NAFLD is generally associated with an unhealthy lifestyle, which may progress to fibrosis and cirrhosis [45]. Optimizing lifestyle through a rational diet, exercise, and a combination of drugs that effectively regulate glucose and lipid metabolism is a proven intervention for NAFLD treatment [48]. The Mediterranean diet is a good choice for NAFLD treatment because it offers numerous health benefits, including weight loss, reduced total cholesterol, antioxidant, and anti-inflammatory effects [46]. Moreover, Genetic and lifestyle factors play an important role in the pathogenesis of NAFLD [8]. That is why public health initiatives that support nutrition and exercise, raise awareness, and improve diagnosis can help manage the growth in future disease burden.

To understand the global burden of NAFLD, it is important to consider a global health problem requiring the attention of the World Health Organization (WHO) to address this growing health problem across the globe [67].

Since its first description as the "unnamed disease" in 1980 [42], the term “non-alcoholic” was first used to describe the liver histology associated with excess liver fat in the absence of significant alcohol consumption [16]. In 1986, Schaffner first introduced the term NAFLD [33]. After 3 decades in 2019, NAFLD was redefined to MAFLD. It was the resolution of a group of experts who offered redefining NAFLD to an alternative terminology, metabolic dysfunction-associated fatty liver disease (MAFLD) [10]. MAFLD is suggested as a more suitable term, since it more accurately represents the disease's pathogenetic basis and facilitates a more thorough and consistent patient management strategy [13]. The term also highlights the complex and diverse characteristics of this disease and prevents overgeneralization as fatty liver disease in the absence of excess alcohol intake [2]. The etiology of MAFLD is multifactorial, involving the following factors: lifestyles, dietary factors, individual inheritance, and so on [60].

To acknowledge the role of dysmetabolism in liver disease in at-risk individuals who may also display hepatic comorbidities like viral hepatitis or behaviors like moderate alcohol intake, a new nomenclature must be adopted promptly. Additionally, they stress that a generic word will actively recognize disease heterogeneity, such as among people who may be obese or thin [34]. Substantial momentum will be necessary to adopt the suggested transition from NAFLD to MAFLD completely, and there are valid concerns that redefining and renaming the illness may confuse patients and professionals alike [59].

NAFLD is a complex metabolic disorder strongly associated with obesity, diabetes, dyslipidemia, and cardiovascular disease [38]. Moreover, NAFLD is associated with aging, too [14]. The high prevalence of NAFLD is linked to overnutrition and intake of highly processed foods [9].

The diagnostic criteria for metabolic dysfunction are straightforward and include the presence of Type 2 diabetes mellitus, overweight or obesity, or clinical markers of metabolic dysfunction such as increased waist circumference or abnormal glycemia or lipid profiles [44].

Scientists predict a slight increase in NAFLD cases (0-30%) between 2016 and 2030. China will see the largest increase in NAFLD due to urbanization, while Japan will experience the lowest growth due to population decline. However, both conditions are becoming increasingly prevalent as the epidemics of obesity and diabetes continue to increase [7]. It is important to manage blood glucose and lipids in obesity in NAFLD prevention due to the mediation effects of type 2 diabetes and dyslipidemia in the association between BMI and NAFLD [68].

Coffee and tea consumption in NAFLD

Coffee and tea are the two most commonly consumed beverages globally [56]. Caffeine, one of the world's most widely consumed pharmacologically active ingredients, is the main component of coffee and tea [55]. But coffee is generally divided into regular coffee and decaffeinated coffee [63]. Approximately 80% of people worldwide use caffeine because it is a socially acceptable drug and a widely accessible psychostimulant [15]. Over 100 compounds have been identified in coffee extracts, many of several compounds have hepatoprotective health benefits [51].

Unfortunately, no recommendations were given for coffee consumption by the associations EASL-EASD–EASO, APASL. ESPEN just mentioned that coffee is more likely to benefit health than harm [53]. *Patress Ann Persons* reviewed that regular coffee consumption has a favorable effect on NAFLD [43]. Newer evidence supports the role of coffee as a therapeutic agent in metabolic liver disease, especially in lower aminotransferase levels, slower fibrosis progression, and less frequent decompensation of cirrhosis [6].

Many diseases like Kidney Stones [69], type 2 diabetes [39], and stroke [57] have been associated with coffee and tea consumption. On the other hand, the positive effects of coffee and tea on liver functions have been well-documented over the past three decades [3].

Results of the National Health and Nutrition Examination Survey (1999-2014) showed that moderate caffeine intake is associated with a lower risk of all-cause mortality in a large study of U.S. adults, especially among those who are overweight. It means that overweight individuals have benefited from moderate caffeine intake. [30]. However, the use of ‘cups per day’ as a form of measurement, as cup size can vary significantly, and this will have a notable impact on the exact amount of coffee that is consumed [54]. Compared to non-coffee drinkers, frequent coffee drinking, particularly 2–3 cups per day, was linked to a lower risk of hepatocellular carcinoma (HCC) and chronic liver disease (CLD) mortality, and the benefits were higher for those who drank ≥4 cups per day [35], the risk was halved with consumption of 5 cups per day [24] A meta-analysis of 11 epidemiological studies confirmed that regular coffee consumption is significantly associated with a reduced risk of NAFLD [18].

In Table 1, we demonstrate some results of studies about the positive effects of coffee consumption, demonstrating the PICO model.

In 2016, there were 5.53 million tonnes of tea consumed worldwide, with a 4.5% annual increase from 2007 to 2016. Tea consumption is significantly lower in

high-income countries, often one-fifth that of low- and middle-income countries [8].

Historically, tea has been claimed to have various health benefits and is used for medical purposes like cancer prevention [22], reduction of the risk of dementia [21], and preventive effects against influenza infection [61].

In Table 2, we show some research results about the effects of tea consumption mostly among mice.

Table 1.

Effects of coffee consumption on liver function.

Research	PICOS	Effects
Coffee consumption is associated with lower liver stiffness: a nationally representative study [12]	P - 4,510 participants/ ≥20 years' old I – Coffee C- Coffee, decaffeinated coffee, tea O – decreasing liver stiffness S- Cross-sectional study	Subjects who drank more than three cups of coffee had significantly lower liver stiffness measurements (LSM). In contrast, there was no significant relationship between LSM and either decaffeinated coffee or tea. In this logistic regression analysis, only >3 cups of coffee remained significantly associated with LSM (OR 0.5, 95%CI 0.2–0.9, p=0.03).
Exploring the impact of coffee consumption on liver health: A comprehensive bibliometric analysis [29]	S – Review using bibliometric analysis	The research primarily revolves around the preventive effects of coffee on various liver diseases and its hepatoprotective properties, including HBV and HCV infections, ALD, NAFLD, cirrhosis, liver failure, and HCC.
Coffee consumption and liver-related hospitalizations and deaths in the ARIC study [19]	P- 14,208 participants aged 45–64 years I - Coffee consumption (cups/day) C- coffee drinkers ≥3 cups/day of coffee / never-drinkers O- liver-related hospitalization S - Prospective analysis	Consuming ≥3, cups/day of coffee was significantly associated with a reduced risk of liver-related hospitalizations compared with never-drinkers (hazard ratio: 0.79, 95% CI: 0.63–0.99). Coffee consumers may be at lower risk for liver-related hospitalizations. A healthy diet can include moderate amounts of coffee (3–5 cups daily).

Table 2.

Effects of different types of tea on liver functions.

Name of tea	Effects on liver functions	
	Studies showed mostly positive effects among mice	Registered a limited number of publications related to studies among people in PubMed
Bowl Tea (Tuocha)	Raw Bowl Tea polyphenols effectively improved the imbalanced lipid metabolism in the serum and liver tissue; furthermore, it reduced the mice's hepatic inflammatory response in NAFLD [31]	No publications
Kombucha Tea	Through the regulation of lipid metabolism, Kombucha Tea protects hepatocytes from lipid toxicity. Additionally, it reduces inflammation and fibrosis, which leads to liver repair in mice with NAFLD [26]. This probiotic drink has a beneficial effect in reducing the metabolic alterations associated with diet-induced obesity in mice [36].	No publications
Three Flower Tea	Three Flower Tea could prevent and treat NAFLD by reducing lipid levels, enhancing insulin sensitivity, decreasing inflammation, and lowering oxidative stress in mice [65].	No publications
Green tea	Green tea combined with exercise can relieve hepatic steatosis and obesity complications in mice fed a high-fat diet by reducing inflammation, lipid production, and improving glucose transport and metabolism [62]. CGT could make the abnormal metabolic state return to normal by intervening in different metabolic pathways to partially reverse the lipid metabolism disorder, and reduce the risk of atherosclerosis and non-alcoholic fatty liver caused by high-fat diet feeding, which may be ascribed to the anti-HLP, anti-oxidant and anti-inflammatory effects of its ingredients [71].	
Citrus maxima and tea	The anatomical and pathological results showed that CMT relieved fatty liver in mice and reduced excessive lipid deposition and inflammatory infiltration. Active ingredients of CMT might be beneficial in NAFLD therapy [64].	No publications

Conclusion. Moderate coffee consumption (3 cups per day) is recommended for patients with NAFLD to prevent the development of liver fibrosis. More research needs to be conducted to evaluate the effects of tea on people soon. Clinical protocol on MAFLD is in the process of development in Kazakhstan.

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