MROSZCZYK, Sylwia Maria, KOWALCZYK, Zuzanna, NOWICKI, Dawid, MUSZYŃSKA, Małgorzata, SUROWANIEC, Julia and KARAŚ, Katarzyna. Coffee Intake: Benefits and Potential Health Hazards. Quality in Sport. 2026;50:67819. eISSN 2450-3118.
https://doi.org/10.12775/QS.2026.50.67819
https://apcz.umk.pl/QS/article/view/67819

The journal has been awarded 20 points in the parametric evaluation by the Ministry of Higher Education and Science of Poland. This is according to the Annex to the announcement of the Minister of Higher Education and Science dated 05.01.2024, No. 32553. The journal has a Unique Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).
The authors declare that there is no conflict of interest regarding the publication of this paper.
Received: 29.12.2025. Revised: 24.01.2026. Accepted: 24.01.2026. Published: 30.01.2026.

Coffee Intake: Benefits and Potential Health Hazards

Sylwia Mroszczyk[1], ORCID https://orcid.org/0000-0003-2395-482X

E-mail mroszczyksylwia@gmail.com

[1]Provincial Specialist Hospital named after Cardinal Stefan Wyszyński in Lublin, Poland

Zuzanna Kowalczyk[2], ORCID https://orcid.org/0009-0005-2205-4901

E-mail zuzanna.kovv@gmail.com

[2]Scientific Research Group of Deparment of Normal, Clinical and Imaging Anatomy, Medical University, Lublin, Poland

Dawid Nowicki[3], ORCID https://orcid.org/0009-0005-2396-3461

E-mail dawidnowicki51@gmail.com

[3]University Clinical Hospital No. 1, named after Professor Tadeusz Sokołowski of the Pomeranian Medical University in Szczecin, Szczecin, Poland

Małgorzata Muszyńska[4], ORCID https://orcid.org/0009-0008-4011-4631

E-mail gosia.muszynska5@gmail.com

[4]Lower Silesian Center of Oncology, Pulmonology and Hematology in Wrocław, Wrocław, Poland

Julia Surowaniec[5], ORCID https://orcid.org/0009-0008-5469-7727

E-mail juliasurowaniec@wp.pl

[5]Independent Public Clinical Hospital named after Andrzej Mielęcki of the Silesian Medical University in Katowice, Katowice, Poland

[6]Katarzyna Karaś, ORCID https://orcid.org/0009-0008-1665-6780

E-mail katarzynaa.karas@gmail.com

[6] Non-Public Health Care Center “Cor” Medical Clinic, Wieruszów, Poland

Corresponding Author

Sylwia Mroszczyk E-mail mroszczyksylwia@gmail.com

Abstract

Introduction

Coffee is one of the most widely consumed beverages in the world, valued both for its sensory qualities and, increasingly, for its potential health benefits. Global daily consumption is estimated at approximately 2.23 billion cups. The literature emphasizes that the varying content of biologically active compounds in coffee is significantly influenced by factors such as its preparation method, extraction time, brewing pressure, and temperature.

Aim of the study

The aim of this study is to discuss and examine how drinking coffee affects humans from various interdisciplinary perspectives, as well as to present both the beneficial and potential adverse effects of coffee consumption.

Methods

A narrative review of the scientific literature was conducted using the Google Scholar, PubMed, and Elsevier databases. Articles published between 2017 and 2025 were included, with selected earlier publications considered due to their scientific relevance. A total of 49 articles, including observational studies, experimental research, and systematic reviews, were analyzed.

Brief description of state of knowledge

Coffee is a rich source of chemical compounds such as chlorogenic acid, caffeine, and caffeic acid.

These biologically active compounds reduce the risk of neurodegenerative diseases, Alzheimer's and Parkinson's disease, reduce the risk of type 2 diabetes, and reduce the risk of dementia. Coffee consumption prolongs and improves the quality of life, supports increased tolerance to physical exercise, and has antioxidant properties.

Summary

Coffee has a complex composition and affects the body in many ways, and its effects depend on individual predispositions and the amount consumed. In moderate doses, it can provide health benefits, such as reducing the risk of certain cancers and cardiovascular diseases. However, excessive amounts can lead to side effects, including excitability, sleep problems, and digestive problems. The overall effect of coffee depends on lifestyle and personal characteristics.

Keywords

coffee, caffeine, Alzheimer’s disease, cardiovascular diseases

1. Introduction

Coffee is consumed by people worldwide primarily for its sensory qualities; however, its health-promoting properties are increasingly being recognized [1]. It is estimated that approximately 2.23 billion cups of coffee are consumed globally each day [2]. Coffee is a rich source of biologically active compounds that exhibit a wide range of health benefits [3]. The daily intake of caffeine considered safe is approximately 400 mg [4]. Other sources indicate that a daily caffeine dose of 200–300 mg exerts beneficial effects on human health, which corresponds to approximately 5–6 cups of espresso. Exceeding a daily intake of 500 mg of caffeine may contribute to the development of dependence and adverse effects, such as excessive stimulation, increased heart rate, chest pain, and sleep disturbances [5]. Additional reasons for coffee consumption include its distinctive taste and aroma, reduction of fatigue, and enhancement of physical performance [6,7]. It is believed that differences in the content of active compounds in coffee may be influenced by various factors, including preparation methods, brewing time, pressure, temperature, and additives such as sugar and milk [8].

2. Aim of the study

The aim of this study is to present and analyze the effects of coffee consumption on humans from an interdisciplinary perspective, encompassing biological and medical aspects, as well as to highlight both the beneficial and potentially adverse consequences of its consumption.

3. Materials and methods

This literature review was conducted based on a comprehensive analysis of scientific publications available in the Google Scholar, PubMed, and Elsevier databases. The literature search focused on articles published between 2017 and 2025; however, for justified reasons, several earlier publications were also included. Of the identified materials, 49 articles were ultimately selected for further analysis. Thirty-three of these contained only general information, whereas 16 articles were based on specific scientific studies.

4. State of knowledge

4.1. Therapeutic properties of coffee

Coffee is a rich source of compounds such as chlorogenic acid, caffeine, caffeic acid, kahweol, trigonelline, melanoidins, ferulic acid, and cafestol [2,9,10]. These biologically active compounds reduce the risk of neurodegenerative diseases, including Alzheimer's and Parkinson's disease, lower the risk of type 2 diabetes, and decrease the likelihood of developing dementia. Moreover, they are associated with a reduced risk of gastrointestinal cancers, accelerated metabolism, decreased fatigue, and improved memory and concentration. Coffee consumption has been shown to prolong and improve quality of life, enhance tolerance to physical exertion, and the chemical compounds contained in coffee exhibit antioxidant properties [3].

Coffee demonstrates therapeutic properties when consumed in appropriate amounts. However, no unequivocal consensus has been established, as previously cited data indicate a daily caffeine intake of 200–400 mg, corresponding to approximately 3–5 cups of espresso per day [11,12].

4.2. Adverse effects of coffee consumption

Caffeine doses exceeding 500 mg are eliminated more slowly from the body. This occurs because the liver is unable to efficiently biotransform caffeine, and the enzymes responsible for its metabolism reach saturation, resulting in prolonged elimination time. Consequently, caffeine exerts prolonged effects on the heart and brain, intensifying its actions, including increased heart rate and contractility, hand tremors, agitation, and the induction of anxiety and nervousness [13].

According to Alshahrani et al., high dietary caffeine intake was associated with lower LDL cholesterol levels, lower systolic blood pressure, reduced insulin resistance, and higher HDL cholesterol levels in overweight and obese individuals [14]. Saraiva et al. reported that the negative effects of coffee consumption are most often related to caffeine withdrawal rather than overdose. Symptoms such as headache, fatigue, irritability, muscle pain, sleep disturbances, and nausea result from the sudden absence of caffeine in the body. These symptoms typically appear within 12–24 hours, peak at 24–48 hours, and persist for approximately one week [15], despite the fact that caffeine elimination from systemic circulation occurs within approximately 5 hours, indicating rapid metabolism [18]. Exceeding the maximum recommended daily caffeine intake may lead to adverse effects, including impaired concentration, irritability, sleep disturbances, breast size reduction in women, and gastrointestinal disorders such as gastric ulcers [3,16]. The severity of caffeine-related adverse effects primarily depends on the consumed dose [17].

4.3. Chemical compounds present in coffee

4.3.1. Caffeine ($C_8H_{10}N_4O_2$)

Caffeine (1,3,7-trimethylxanthine) is an alkaloid naturally present in coffee, tea, and cocoa beans and belongs to psychoactive compounds. It was first isolated from coffee beans in the 1820s by the German scientist Friedrich Ferdinand Runge [19]. The caffeine content of coffee depends on the method of preparation. According to scientific studies, a standard cup of coffee contains between 65 and 120 mg of caffeine [2,19,20].

Caffeine acts as a competitive antagonist of adenosine, as its molecular structure is similar to that of adenosine [8]. Competition occurs between adenosine and caffeine molecules for the active binding site; binding of caffeine to the receptor results in increased secretion of

catecholamines such as adrenaline, dopamine, and serotonin, which exert stimulatory effects on the human body [21].

4.3.2. Caffeic acid ($C_9H_8O_4$)

Caffeic acid (3,4-dihydroxycinnamic acid) is a hydroxycinnamic acid present in coffee beans and tobacco leaves. The effects of caffeic acid on pregnancy in mice have been extensively studied. It has been shown that caffeic acid may disrupt the implantation process. Additionally, offspring of mothers exposed to caffeic acid exhibited lower body weight gain compared to those of unexposed mothers. However, other studies have demonstrated that caffeic acid does not exhibit teratogenic effects in developing mouse fetuses [12].

4.3.3. Chlorogenic acid ($C_{16}H_{18}O_9$)

Chlorogenic acid is an ester of quinic acid and caffeic acid. Its highest concentrations are found in coffee beans and tea. It has been demonstrated that chlorogenic acid reduces the risk of neurodegenerative diseases, including stroke [3]. Moreover, it decreases intestinal glucose absorption. Coffee consumption has been shown to slow the development of obesity, thereby reducing the risk of type 2 diabetes, regardless of sex [1,10].

4.3.4. Trigonelline

Trigonelline, a metabolite of vitamin B3 [22,23], is a pyridine alkaloid commonly found in coffee beans and fenugreek. Notably, both pyridine and piperidine alkaloids demonstrate the ability to bind β-amyloid molecules, which may be relevant in research on Alzheimer's disease and other neurodegenerative disorders [21,24]. Additionally, trigonelline exhibits antioxidant properties that contribute to improved glucose tolerance.

Javad Fahanik-Babaei conducted a study in rats in which Alzheimer's disease–like symptoms were induced by bilateral injection of aggregated β-amyloid into the CA1 region of the hippocampus. Administration of trigonelline resulted in improved spatial memory and novel object recognition abilities [25].

4.3.5. Ferulic acid ($C_{10}H_{10}O_4$)

Ferulic acid (4-hydroxy-3-methoxycinnamic acid) is a derivative of cinnamic acid. It has been demonstrated to possess antioxidant properties, inhibit reactive oxygen species, and reduce oxidative stress. Furthermore, it exhibits antioxidant effects against low-density lipoproteins.

Due to its strong antioxidant properties, as described by Fahanik-Babaei et al., ferulic acid has attracted attention as a potential anticancer compound [26].

4.3.6. Kahweol ($C_{20}H_{26}O_3$) and cafestol ($C_{20}H_{28}O_3$)

Kahweol and cafestol are natural diterpenes present in large amounts in coffee beans. Both compounds exhibit anticancer activity against colorectal, liver, and endometrial cancers, as well as anti-inflammatory and antidiabetogenic effects. Moreover, they may reduce the risk of osteoporosis by modulating osteoclast activity and limiting excessive bone resorption [12]. They also regulate metabolism by interacting with LDL receptors involved in lipoprotein endocytosis [27].

4.4. Caffeine metabolism

Approximately 95% of caffeine is metabolized in the liver via cytochrome CYP1A2 (Cytochrome P450 1A2), while 3% or less is excreted unchanged in the urine [28]. Complete absorption of caffeine from the gastrointestinal tract occurs within approximately 45 minutes after consumption. Peak plasma caffeine concentrations are reached between 50 and 150 minutes post-ingestion [16]. Juliana de Paula et al. described the plasma half-life of caffeine as variable, averaging between 2.5 and 5 hours in adults. The shortest recorded half-life was 2.3 hours, while the longest reached up to 12 hours, indicating substantial interindividual variability in caffeine elimination [29].

During caffeine metabolism, paraxanthine (67–82%) is produced in the greatest amount, along with theobromine and theophylline [30,31]. The CYP1A2 gene, which encodes enzymes involved in the metabolism of various substances, plays a key role in the biotransformation of caffeine, paraxanthine, and theobromine [32]. The rate of caffeine metabolism is largely genetically determined by CYP1A2 activity [31]. Additionally, medications and cigarette smoking influence caffeine metabolism [10]. Smoking increases caffeine clearance and shortens its half-life, whereas oral contraceptive use slows caffeine metabolism [32].

4.5. Effect of coffee on fatigue

Adenosine binds to adenosine receptors located on the surface of nerve cells, generating neural signals transmitted to the brain that indicate fatigue. Caffeine acts as an antagonist of these receptors, blocking adenosine binding and preventing signal generation, thereby inhibiting fatigue perception in the central nervous system. Adenosine affects multiple systems, including the genitourinary, nervous, cardiovascular, immune, and respiratory systems [33]. It functions

as a metabolic signal indicating an imbalance between energy supply and demand, triggering compensatory mechanisms such as increased cerebral blood flow [34]. By blocking adenosine receptors, caffeine can inhibit many of adenosine's effects not only in the brain but also in other systems, thereby modifying its overall physiological impact [35].

4.6. Effect of coffee on the development of Alzheimer's Disease

Due to the increasing prevalence of neurodegenerative diseases, the relationship between coffee consumption and Alzheimer's disease incidence has been analyzed. A prospective study conducted in Canada included individuals aged 65 years and older and assessed Alzheimer's disease occurrence. The study involved 6,434 participants who completed a risk assessment questionnaire twice at regular five-year intervals. At baseline, all participants demonstrated normal cognitive function as assessed by the Mini–Mental State Examination (MMSE). After five years, cognitive status was reassessed. Analysis revealed that regular coffee consumption was associated with a 31% lower risk of developing Alzheimer's disease, suggesting a potential protective effect of caffeine on cognitive function in older adults [36,37].

4.7. Effect of coffee on the cardiovascular system

Statistical data reported by M. Ding et al. indicated that consumption of approximately 3–4 cups of coffee per day was associated with a higher frequency of cardiovascular risk, whereas lower or higher intake levels provided fewer benefits or no protective effect [38].

Findings regarding the impact of coffee consumption on coronary heart disease risk remain inconsistent. Y. Park et al. analyzed 32 studies and found no significant association between coffee intake and coronary heart disease risk. Further analysis revealed that coffee consumption significantly increased coronary heart disease risk in men, whereas no such correlation was observed in women [39]. Conversely, an increasing number of epidemiological studies recommend coffee consumption for the prevention of cardiovascular diseases, stroke, and mortality [40]. Other authors report that regular coffee intake is associated with a reduced risk of hypertension, heart failure, hypercholesterolemia, and atrial fibrillation [41]. There are also reports suggesting that coffee consumption may protect against atrial arrhythmias, particularly atrial fibrillation [42].

4.8. Effect of coffee consumption on the gastrointestinal system

According to observations by Taborska et al., coffee consumption offers various benefits, including improved digestion and accelerated gastrointestinal transit. Coffee stimulates gastric

acid secretion, increases bile and pancreatic enzyme production, reduces the risk of gallstone formation, enhances colonic motility, and modulates gut microbiota. Despite these effects, coffee is not considered a significant risk factor for gastroesophageal reflux disease, peptic ulcers, inflammatory bowel disease, or gastrointestinal cancers [43].

In contrast, Koochakpoor et al. evaluated the association between coffee and caffeine intake and the risk of irritable bowel syndrome (IBS). Their findings indicated that both coffee and caffeine consumption were significantly associated with an increased risk of IBS. This association was particularly pronounced among women and individuals with obesity [44].

4.9. Effect of coffee on other systems and organs

Moon-Kyung et al. demonstrated that high consumption of instant coffee was associated with the development of chronic obstructive pulmonary disease (COPD) in individuals with a smoking history exceeding 20 pack-years or in never-smokers [42]. Similar conclusions regarding coffee consumption and COPD development were reported by Wan-Zhe et al. [45].

Zdrojewicz et al. observed that caffeine is rapidly absorbed, crosses the blood–brain barrier, and exhibits a broad pharmacological profile, including use in antiasthmatic preparations, which may indirectly suggest its effects on bronchial vasculature and the cardiovascular system [46].

Xiaoling et al. demonstrated that caffeine intake may prolong pregnancy duration, although results may be confounded by factors such as tobacco smoking. Even doses below 200–300 mg per day may be associated with adverse reproductive outcomes, including an increased risk of spontaneous miscarriage [47].

4.10. Effect of coffee consumption on cancer development

Iriondo-DeHond et al. conducted a systematic review of scientific literature on the relationship between coffee consumption and cancer development. Based on the collected studies, they concluded that coffee consumption has a protective effect against liver cancer, hepatocellular carcinoma, and breast cancer. However, coffee intake may increase the risk of lung cancer. For other cancers, including pancreatic, bladder, ovarian, and prostate cancer, the association with coffee consumption remains inconclusive [48]. Carter et al. explain that current scientific evidence is limited due to challenges inherent to observational studies, including the risk of reverse causality and confounding factors. This is particularly relevant for coffee consumption, which often co-occurs with other lifestyle-related behaviors [49].

5. Conclusions

Coffee is a beverage with a complex chemical composition and multidirectional biological activity. Its effects on the human body depend on individual predispositions and the amount consumed. Excessive intake may contribute to adverse effects such as increased excitability, irritability, and sleep disturbances. Regular coffee consumption is associated with potential health benefits, including protective effects against Alzheimer's disease and certain cancers, such as liver and breast cancer.

Current research on the impact of coffee consumption on the cardiovascular system yields inconclusive results. Moderate coffee intake, defined as approximately 3–4 cups per day, may be associated with either an increased or decreased risk of cardiovascular diseases, depending on sex and individual factors. At the same time, a growing body of evidence suggests that regular coffee consumption may contribute to a reduced risk of hypertension, heart failure, atrial fibrillation, stroke, and overall mortality, as well as exhibit a potential protective effect against atrial arrhythmias.

Coffee supports gastrointestinal function and may reduce the risk of cardiovascular diseases; however, its effects on the heart may vary according to sex and the amount of caffeine consumed. Nevertheless, caffeine intake is associated with an increased risk of irritable bowel syndrome, chronic obstructive pulmonary disease in smokers, and potentially adverse reproductive outcomes at high doses. Overall, the compounds present in coffee demonstrate protective properties, although the extent of their effects may vary depending on individual characteristics and lifestyle factors.

Disclosure

Author's Contribution:

Conceptualisation - Sylwia Mroszczyk and Zuzanna Kowalczyk
methodology - Zuzanna Kowalczyk
software - Dawid Nowicki i Julia Surowaniec
check - Małgorzata Muszyńska, Zuzanna Kowalczyk and Julia Surowaniec
formal analysis - Sylwia Mroszczyk i Małgorzata Muszyńska

investigation - Dawid Nowicki
resources - Sylwia Mroszczyk
data curation - Małgorzata Muszyńska
writing - rough preparation - Sylwia Mroszczyk
writing - review and editing - Dawid Nowicki and Julia Surowaniec
visualization - Katarzyna Karaś i Małgorzata Muszyńska
supervision - Małgorzata Muszyńska and Dawid Nowicki
project administration - Sylwia Mroszczyk i Dawid Nowicki

All authors have read and agreed with the published version of the manuscript.

Funding statement:

The study did not receive special funding.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Not applicable.

Data Availability Statement:

Not applicable.

Conflict of Interest Statement:

The authors declare no conflict of interest.

References

1. Pelczyńska M, Bogdański P. Prozdrowotne właściwości kawy. Varia Medica 2019;3:311–7. https://journals.viamedica.pl/varia_medica/article/view/67446
2. Surma S, Oparil S. Coffee and Arterial Hypertension. Curr Hypertens Rep. 2021;23:38. https://doi.org/10.1007/s11906-021-01156-3
3. Naveed M, Hejazi V, Abbas M, et al. Chlorogenic acid (CGA): A pharmacological review and call for further research. Biomed Pharmacother. 2018;97:67–74. https://doi.org/10.1016/j.biopha.2017.10.064
4. Barrea L, Pugliese G, Frias-Toral E, et al. Coffee consumption, health benefits and side effects: a narrative review and update for dietitians and nutritionists. Crit Rev Food Sci Nutr. 2023;63:1238–61. https://doi.org/10.1080/10408398.2021.1963207.
5. Czarniecka-Skubina E, Pielak M, Sałek P, et al. Consumer Choices and Habits Related to Coffee Consumption by Poles. Int J Environ Res Public Health. 2021;18:3948. https://doi.org/10.3390/ijerph18083948
6. Ferreira J, Ferreira C, Bos E. Spaces of consumption, connection, and community: Exploring the role of the coffee shop in urban lives. Geoforum. 2021;119:21–9. https://doi.org/10.1016/j.geoforum.2020.12.024
7. Spence C, Carvalho FM. The coffee drinking experience: Product extrinsic (atmospheric) influences on taste and choice. Food Qual Prefer. 2020;80:103802. https://doi.org/10.1016/j.foodqual.2019.103802
8. Baspinar B, Eskici G, Ozcelik AO. How coffee affects metabolic syndrome and its components. Food Funct. 2017;8:2089–101. https://doi.org/10.1039/C7FO00388A
9. Chemical composition and health properties of coffee and coffee by-products. Adv Food Nutr Res. 2020; 91: 65–96. https://doi.org/10.1016/bs.afnr.2019.10.002
10. Wierzejska R. Kofeina – powszechny składnik diety i jej wpływ na zdrowie. Rocz Panstw Zakl Hig. 2012;63:141–7. https://pubmed.ncbi.nlm.nih.gov/22928360/
11. Frankowski M, Kowalski A, Ociepa A, et al. Kofeina w kawach i ekstraktach kofeinowych i odkofeinowanych dostępnych na polskim rynku. Bromatol Chem Toksykol. 2008;41:21–7. https://katalogi.bn.org.pl/permalink/48OMNIS_NLOP/18406m1/alma991048814639705066
12. Ren Y, Wang C, Xu J, et al. Cafestol and Kahweol: A Review on Their Bioactivities and Pharmacological Properties. Int J Mol Sci. 2019;20:4238. https://doi.org/10.3390/ijms20174238

13. Zhou X, Zhang L. The neuroprotective effects of moderate and regular caffeine consumption in Alzheimer's disease. Oxid Med Cell Longev. 2021;2021:5568011. https://doi.org/10.1155/2021/5568011
14. Alshahrani SH, Atia YA, Badir RA, et al. Dietary caffeine intake is associated with a favorable metabolic profile among apparently healthy overweight and obese individuals. BMC Endocr Disord. 2023;23:227. https://doi.org/10.1186/s12902-023-01477-1
15. Saraiva SM, Jacinto TA, Gonçalves AC, et al. Overview of caffeine effects on human health and emerging delivery strategies. Pharmaceuticals. 2023;16:1067.https://doi.org/10.3390/ph16081067
16. Mikami Y, Yamazawa T. Chlorogenic acid, a polyphenol in coffee, protects neurons against glutamate neurotoxicity. Life Sci. 2015;139:69–74. https://doi.org/10.1016/j.lfs.2015.08.005
17. Rodak K, Kokot I, Kratz EM. Caffeine as a Factor Influencing the Functioning of the Human Body—Friend or Foe? Nutrients. 2021;13:3088. https://doi.org/10.3390/nu13093088
18. 18. Cappelletti S, Daria P, Sani G, et al. Caffeine: Cognitive and Physical Performance Enhancer or Psychoactive Drug? Curr Neuropharmacol. 2015;13:71–88. https://doi.org/10.2174/1570159X13666141210215655
19. Nieber K. The impact of coffee on health. Planta Med. 2017;83:1256–63.
20. Surma S, Romańczyk M, Fojcik J, et al. Kawa — lekarstwo, używka i narkotyk. Psychiatria. 2020;17:237–46. https://doi.org/10.5603/PSYCH.a2020.0031
21. Kietliński MN, Kornacki M. Kofeina w „życiu człowieka". Spożycie produktów kofeinowych przez młodych dorosłych n.d.
22. Szczesny D. Oznaczanie fizykochemicznych i biochemicznych właściwości naturalnych alkaloidów pirydynowych i piperydynowych oraz ich prostych pochodnych, istotnych dla działania przeciwko chorobie Alzheimera [praca doktorska]. Gdańsk: Gdański Uniwersytet Medyczny; 2016. http://dx.doi.org/10.48745/ppm.03n5-xk49
23. Król-Kogus B, Krauze-Baranowska M. Kozieradka pospolita Trigonella foenum graecum L.–tradycja stosowania na tle wyników badań naukowych. Postępy Fitoter. 2011;3:185–90. https://www.researchgate.net/publication/268978711_Kozieradka_pospolita_Trigonella_foenum_graecum_L_-_tradycja_stosowania_na_tle_wynikow_badan_naukowychhttps://www.researchgate.net/

publication/268978711_Kozieradka_pospolita_Trigonella_foenum_graecum_L_-_tradycja_stosowania_na_tle_wynikow_badan_naukowych

24. Gaur V, Bodhankar SL, Mohan V, et al. Neurobehavioral assessment of hydroalcoholic extract of Trigonella foenum-graecum seeds in rodent models of Parkinson's disease. Pharm Biol. 2013;51:550–7. https://doi.org/10.3109/13880209.2012.747547
25. Fahanik-Babaei J, Baluchnejadmojarad T, Nikbakht F, et al. Trigonelline protects hippocampus against intracerebral Aβ (1–40) as a model of Alzheimer's disease in the rat: Insights into underlying mechanisms. Metab Brain Dis. 2019;34:191–201. https://doi.org/10.1007/s11011-018-0338-8
26. Kim H, Kim SR, Jung UJ. Coffee and Its Major Polyphenols in the Prevention and Management of Type 2 Diabetes: A Comprehensive Review. Int J Mol Sci. 2025;26:5544. https://doi.org/10.3390/ijms26125544
27. Rustan AC, Halvorsen B, Huggett AC, et al. Effect of Coffee Lipids (Cafestol and Kahweol) on Regulation of Cholesterol Metabolism in HepG2 Cells. Arterioscler Thromb Vasc Biol. 1997;17:2140–9. https://doi.org/10.1161/01.ATV.17.10.2140
28. Alsabri SG, Mari WO, Younes S, et al. Kinetic and dynamic description of caffeine. J Caffeine Adenosine Res. 2018;8:3–9. https://doi.org/10.1089/caff.2017.0011
29. dePaula J, Farah A. Caffeine consumption through coffee: Content in the beverage, metabolism, health benefits and risks. Beverages. 2019;5:37. https://doi.org/10.3390/beverages5020037
30. Balawejder-Biśto A, Pyka-Pająk A. Kofeina–substancja znana czy poznawana. Farm Pol. 2022;78:430–41. http://dx.doi.org/10.32383/farmpol/155158
31. Detlaff G, Samaszko-Fiertek J, Madaj J, et al. Kofeina: właściwości i przykłady wykorzystania. Wiad Chem. 2020;74:527–43. https://ptchem.pl/storage/pages/July2020/zeszyt_7_8.pdf
32. Grzegorzewski J, Bartsch F, Köller A, et al. Pharmacokinetics of caffeine: a systematic analysis of reported data for application in metabolic phenotyping and liver function testing. Front Pharmacol. 2022;12:752826. https://doi.org/10.3389/fphar.2021.752826
33. Ciruela F, Saura C, Canela EI, et al. Ligand-Induced Phosphorylation, Clustering, and Desensitization of A1 Adenosine Receptors. Mol Pharmacol. 1997;52:788–97. https://doi.org/10.1124/mol.52.5.788
34. van Calker D, Biber K, Domschke K, et al. The role of adenosine receptors in mood and anxiety disorders. J Neurochem. 2019;151:11–27. https://doi.org/10.1111/jnc.14841

35. Van Dijk R, Ties D, Kuijpers D, et al. Effects of Caffeine on Myocardial Blood Flow: A Systematic Review. Nutrients. 2018;10:1083. https://doi.org/10.3390/nu10081083
36. Lindsay J, Laurin D, Verreault R, et al. Risk factors for Alzheimer's disease: a prospective analysis from the Canadian Study of Health and Aging. Am J Epidemiol. 2002;156:445–53. https://doi.org/10.1093/aje/kwf074
37. Merighi S, Travagli A, Nigro M, et al. Caffeine for prevention of Alzheimer's disease: Is the A2A adenosine receptor its target? Biomolecules. 2023;13:967. https://doi.org/10.3390/biom13060967
38. Ding M, Bhupathiraju SN, Satija A, et al. Long-Term Coffee Consumption and Risk of Cardiovascular Disease: A Systematic Review and a Dose–Response Meta-Analysis of Prospective Cohort Studies. Circulation 2014;129:643–59. https://doi.org/10.1161/CIRCULATIONAHA.113.005925
39. Park Y, Cho H, Myung S-K. Effect of Coffee Consumption on Risk of Coronary Heart Disease in a Systematic Review and Meta-Analysis of Prospective Cohort Studies. Am J Cardiol. 2023;186:17–29. https://doi.org/10.1016/j.amjcard.2022.10.010
40. Cicero AFG, Fogacci F, D'Addato S, et al. Self-Reported Coffee Consumption and Central and Peripheral Blood Pressure in the Cohort of the Brisighella Heart Study. Nutrients 2023;15:312. https://doi.org/10.3390/nu15020312
41. Mendoza MF, Sulague RM, Posas-Mendoza T, et al. Impact of Coffee Consumption on Cardiovascular Health. Ochsner J. 2023;23:152–8. https://doi.org/10.31486/toj.22.0073
42. Chieng D, Kistler PM. Coffee and tea on cardiovascular disease (CVD) prevention. Trends Cardiovasc Med. 2022;32:399–405. https://doi.org/10.1016/j.tcm.2021.08.004
43. Taborska N, Martyka A, Kubicka Figiel M, et al. The impact of consumed coffee on the digestive system - review of the latest research. J Educ Health Sport. 2024;53:32–43. https://doi.org/10.12775/JEHS.2024.53.003
44. Koochakpoor G, Salari-Moghaddam A, Keshteli AH, et al. Association of Coffee and Caffeine Intake With Irritable Bowel Syndrome in Adults. Front Nutr. 2021;8:632469. https://doi.org/10.3389/fnut.2021.632469
45. Liao W-Z, Li J-X, Feng W-Y, et al. Association between coffee and caffeine intake and risk of COPD: Findings based on NHANES 2007–2012. Heart Lung. 2024;67:53–61. https://doi.org/10.1016/j.hrtlng.2024.04.015
46. Zdrojewicz Z, Grześkowiak K, Łukasiewicz M. Czy picie kawy jest zdrowe. Med Rodz. 2016;3:138–45. https://www.czytelniamedyczna.pl/5649,czy-picie-kawy-jest-zdrowe.html#kod

47. Ma X, Wu L, Wang Y, et al. Diet and human reproductive system: Insight of omics approaches. Food Sci Nutr. 2022;10:1368–84. https://doi.org/10.1002/fsn3.2708
48. Iriondo-DeHond A, Uranga JA, Del Castillo MD, et al. Effects of Coffee and Its Components on the Gastrointestinal Tract and the Brain–Gut Axis. Nutrients. 2020;13:88. https://doi.org/10.3390/nu13010088
49. Carter P, Yuan S, Kar S, et al. Coffee consumption and cancer risk: a Mendelian randomisation study. Clin Nutr. 2022;41:2113–23. https://doi.org/10.1016/j.clnu.2022.08.019