

Q&A on Monographs Volume 116: Coffee, maté, and very hot beverages

Questions about the Monographs

1. What does the IARC Monographs Programme do?

The Monographs Programme identifies and evaluates causes of cancer in humans based on the publicly available scientific evidence. To date, more than 950 agents have been reviewed and classified.

2. What does the classification mean in terms of risk?

The IARC Monographs Programme seeks to classify cancer hazards, meaning the potential of any substance to cause cancer based on current knowledge. The classification includes evidence from epidemiological studies of real-world exposures to carcinogens in human populations. The classification does not indicate what level of risk exists to people's health associated with exposure to a classified hazard. For example, IARC has classified tobacco smoking as *carcinogenic to humans* (Group 1), but that classification does not indicate the increase in risk for each cigarette smoked.

For more information on the IARC classification, read the [IARC Monographs Q&A](#).

Questions about coffee

3. What was the evaluation of coffee drinking?

Coffee drinking is *not classifiable as to its carcinogenicity to humans* (Group 3).

Many epidemiological studies showed that coffee drinking had no carcinogenic effects for cancers of the pancreas, female breast, and prostate, and reduced risks were seen for cancers of the liver and uterine endometrium.

For more than 20 other cancers, the evidence was inadequate to enable a conclusion to be made.

4. What are the main studies that were evaluated?

The most important studies evaluated were epidemiological cohort studies of people who reported their coffee drinking habits and were followed up for many years to see how many of them developed cancer and how that was related to their coffee consumption. There was also important evidence from epidemiological case-control studies and experimental studies in animals and cells in culture.

5. What is new since the previous evaluation?

Coffee drinking was evaluated by IARC in 1991 (Monographs Volume 51). At the time it was classified as *possibly carcinogenic to humans* (Group 2B), based on *limited evidence* from epidemiological studies that coffee causes bladder cancer. *Limited evidence* means that a positive association has been observed between exposure to the agent and cancer but that chance, bias, or confounding could not be ruled out. In the 1991 evaluation, there was also *evidence suggesting lack of carcinogenicity* for the breast and large intestine and *inadequate evidence* for other cancers. The evidence in experimental animals was *inadequate*.

Q&A on Monographs Volume 116: Coffee, maté, and very hot beverages

The current evaluation is based on a much larger and stronger body of evidence. Nearly 500 relevant epidemiological studies on more than 20 different types of cancer were identified.

Many epidemiological studies now available showed that coffee drinking had no carcinogenic effects for cancers of the pancreas, female breast, and prostate, and reduced risks were seen for cancers of the liver and uterine endometrium.

For more than 20 other cancers, the evidence was inadequate to enable a conclusion to be made.

The evidence that drinking coffee might cause bladder cancer, which was *limited* in the previous evaluation, has become weaker, and it is no longer possible to determine whether drinking coffee causes bladder cancer.

6. Why did IARC choose to re-evaluate coffee? Why was coffee seen as a high priority?

Coffee drinking was recommended as a high priority for re-evaluation by an international advisory group (IARC Advisory Group), for two main reasons. First, many new studies have been done in the past 25 years. Second, it was thought that the new studies might clarify the previous evaluation, which had indicated that coffee was *possibly carcinogenic to humans* (Group 2B), based on *limited evidence* for bladder cancer, but found *evidence suggesting lack of effect* for two other types of cancer.

7. How should governments or health agencies use these results?

Identification of a cancer hazard in the IARC Monographs is an important alert that exposure can cause cancer in exposed people. Therefore, the IARC Monographs provide scientific evidence for the World Health Organization, governments, and health agencies to consider in developing health guidelines and policies. However, the Monographs do not recommend what actions should be taken, as those remain the responsibility of the authorities concerned.

8. What types of coffee were evaluated?

Although many different kinds of coffee are available and coffee can be prepared in many different ways, most studies did not look at different kinds of coffee or different ways of preparing it. As a result, there is not enough information to enable conclusions to be made about any particular kind of coffee.

9. What about instant coffee, filter coffee, organic coffee, etc.? Does the way coffee is prepared change anything about the risk of consumption?

The chemical properties of coffee can differ depending on the kind of coffee tree it comes from, how it is processed and roasted, and how it is prepared for drinking. However, the studies that have been reported until now do not show consistent and robust differences in cancer risk for different kinds of coffee or different preparation methods.

10. Does the IARC classification mean that coffee is safe in terms of a potential link to cancer?

A Group 3 evaluation does not mean that a substance has been proven to be safe. It means that the existing scientific data do not enable a conclusion to be made about whether it causes cancer. While this was the case for coffee overall, it was possible to conclude that coffee is unlikely to cause certain cancers, including cancers of the breast, prostate, and pancreas. Reduced risks were seen for cancers of the liver and uterine endometrium.

For more than 20 other cancers, the evidence was inadequate to enable a conclusion to be made.

Q&A on Monographs Volume 116: Coffee, maté, and very hot beverages

11. How could there be a “downgrade” from the previous evaluation?

The human evidence that suggested a link between coffee drinking and bladder cancer in 1991 was classified as *limited* at that time. This meant that although a causal relationship was seen as credible, other explanations such as bias and confounding could not be excluded. Most importantly, many of the early positive studies did not adequately account for tobacco smoking, which is a major risk factor for bladder cancer and can be strongly correlated with coffee drinking. The majority of high-quality studies that have subsequently been published do not show consistent evidence that coffee consumption is associated with bladder cancer.

Question about tea

12. Has tea been evaluated?

Tea was not re-evaluated in this Monograph. IARC evaluated tea as *not classifiable as to its carcinogenicity to humans* (Group 3) in Monographs Volume 51, and this classification is still valid.

Questions about maté

13. What type of maté did IARC evaluate?

Maté is an infusion made from dried leaves of a South American shrub, *Ilex paraguariensis*. Maté is consumed mostly in South America. It is traditionally drunk very hot, using a metal straw. It may also be consumed warm or cold.

14. What is new since the previous evaluation?

When it was evaluated by IARC in 1991, hot maté drinking was classified as *probably carcinogenic to humans* (Group 2A), based on limited evidence from several epidemiological studies from South America that showed associations with cancer of the oesophagus. Maté, without further specification of temperature was evaluated as *not classifiable as to its carcinogenicity to humans* (Group 3). No cancer studies in animals were available at the time.

In the new evaluation, drinking maté that is not very hot was *not classifiable as to its carcinogenicity to humans* (Group 3). There is no specific evaluation for very hot maté, but it is now included in the evaluation of very hot beverages as *probably carcinogenic to humans* (Group 2A).

15. Why was maté a high priority?

Several epidemiological studies of maté drinking that have been conducted since the previous evaluation show the risk of oesophageal cancer increasing with the temperature of the drink. There are also several new experimental studies in animals.

With the availability of new data, the IARC Advisory Group recommended a re-evaluation focused on understanding whether the associations seen in earlier studies were due to maté itself or to the temperature of the drink.

Q&A on Monographs Volume 116: Coffee, maté, and very hot beverages

16. Why did IARC evaluate maté drinking in South America?

The first studies of maté drinking were conducted in an area of South America where the incidence of oesophageal cancer is higher than usual and maté drinking is common. Some studies suggested that maté drinking could be responsible for the increased risk of cancer in this area, but there could be other explanations, such as differences in diet and tobacco use and alcohol consumption.

17. How should governments or health agencies use these results?

The IARC Monographs provide scientific evidence for the World Health Organization, governments, and health agencies to consider in developing health guidelines and policies. However, the Monographs do not recommend what actions should be taken, as those remain the responsibility of the authorities concerned.

18. What are the main studies that IARC based the evaluation on?

The evaluation of maté is based mainly on nine epidemiological case–control studies in Argentina, Brazil, Paraguay, and Uruguay that investigated the association of maté drinking with cancer of the oesophagus. The participants in these studies were asked about their consumption of maté. In some studies they were also asked to describe the typical temperature at which they drank maté. A larger study that pooled data from five earlier ones included detailed statistical analyses of the amount and temperature of maté in relation to the risk of oesophageal cancer.

The carcinogenicity of maté has been studied in only one experiment with rats, where it was given as a drinking liquid.

19. Are these results linked to the temperature of the beverage or the maté itself?

Epidemiological studies found that cancer of the oesophagus is associated with drinking maté at “very hot” temperatures but not with drinking maté warm or cold. Experiments with rats and mice also found effects of very hot liquids but no carcinogenic effects of maté.

Questions about very hot beverages

20. Why did IARC evaluate very hot beverages?

Studies of other hot drinks, mainly tea, in several other countries, including China, the Islamic Republic of Iran, Japan, and Turkey, also found that the risk of oesophageal cancer may increase with the temperature of the drink.

Several experiments with rats and mice also found that very hot liquids can promote the development of tumours in experimental animals.

21. How hot is “very hot”?

Experimental studies with animals suggest that carcinogenic effects probably occur with drinking temperatures of 65 °C or above. In cancer epidemiological studies, people have been asked to describe the usual temperature of beverages they drink. In addition, surveys from regions with a high incidence of cancers of the oesophagus have found that the temperature of very hot drinks was more than 65 °C. Therefore, the definition of very hot beverages as temperatures of 65 °C or above comes from studies in animals and is also supported by real-world measurements of drinking temperatures of beverages. In contrast, the typical drinking temperature for tea and coffee in most parts of the world is below 65 °C.

Q&A on Monographs Volume 116: Coffee, maté, and very hot beverages

22. How can IARC be sure that it is the temperature, and not the beverage, that is a probable cause of oesophageal cancer?

A combined analysis of several epidemiological studies with 1400 cases of oesophageal cancer considered both the temperature and the amount of maté that people drank. The results showed that the risk of cancer increased with temperature, independent of the amount consumed. There were statistically significant increases in risk for drinking very hot maté, but not for drinking warm maté. One other epidemiological study investigated cold maté drinking and found no increased risk. Experiments with rats and mice also found that very hot water (at 65 °C) promoted the development of oesophageal tumours, whereas maté did not.

23. What kind of oesophageal cancer is related to drinking very hot beverages?

There are two types of cancers that arise in different parts of the oesophagus. Squamous cell cancer (from the upper part of the oesophagus) is the most common, accounting for 90% of cases globally, whereas adenocarcinoma (from the lower part of the oesophagus) accounts for 10%.

Smoking and alcohol drinking are risk factors for squamous cell cancer in many high-income countries. However, the majority of oesophageal squamous cell cancers occur in low- and middle-income countries. Most studies of very hot beverages evaluated by the Monographs were in low- and middle-income countries, but didn't specify the type of oesophageal cancer linked to drinking very hot beverages.