GENERAL REMARKS

This one-hundred-and-sixteenth volume of the *IARC Monographs* presents evaluations of the carcinogenic hazard to humans of drinking coffee, mate, and very hot beverages. A summary of the findings of this volume appears in *The Lancet Oncology* (Loomis et al., 2016).

The carcinogenicity of coffee was previously evaluated in Volume 51 of the *IARC Monographs* (IARC, 1991). After reviewing the data available at that time, the Working Group had classified coffee as *possibly carcinogenic to humans* (Group 2B) based on *limited evidence* in humans – derived from some 20 epidemiological case–control studies – that coffee causes cancer of the urinary bladder, and *inadequate evidence* in experimental animals. The same Working Group also concluded that there was *evidence suggesting lack of carcinogenicity* for cancers of the female breast and the colorectum.

In the current evaluation, based on a much larger volume of data comprising more than 1000 observational and experimental studies, the Working Group concluded there is *inadequate evidence* in humans and experimental animals for the carcinogenicity of coffee drinking. With the expanded literature, the Working Group focused their review on higher-quality epidemiological studies of cancer of the bladder and coffee drinking; these did not show a consistent association or a dose–response relationship. The Working Group judged that the positive associations between coffee drinking and cancer of the bladder observed in some studies were probably due to inadequate control for the confounding effects of tobacco smoking, a major risk factor for cancer of the bladder that is often strongly associated with coffee drinking. In considering the data now available for more than 20 other cancer sites in humans, the Working Group found *evidence suggesting lack of carcinogenicity* for cancers of the female breast, uterine endometrium, prostate, pancreas, and liver, and *inadequate evidence* in humans for cancers at all other sites. The Working Group's review of other relevant data found *strong evidence* in humans that coffee has antioxidant effects. As a result of this re-evaluation, the Working Group concluded that drinking coffee is *not classifiable as to its carcinogenicity to humans* (Group 3).

An earlier evaluation of the carcinogenicity of mate was also reported in Volume 51 (IARC, 1991). The evidence available at that time was obtained entirely from epidemiological case–control studies. In that review, the Working Group drew a distinction between mate itself and drinking hot mate, concluding that mate (without further specification) was *not classifiable as to its carcinogenicity to humans* (Group 3), but that drinking hot mate was *probably carcinogenic to humans* (Group 2A). Taking into account the previous evaluation, in addition to new data in humans and experimental animals, an Advisory Group that met in 2014 gave high priority to evaluating the carcinogenicity of drinking hot mate

and other hot beverages (Straif et al., 2014). In light of the evidence available at the present time, the current Working Group chose to evaluate the carcinogenicity of very hot beverages, including, but not limited to, mate. Epidemiological studies of cancer risk and drinking temperature for a variety of hot beverages, as well as co-carcinogenicity experiments in which hot liquids were administered to animals, were accordingly taken into consideration. The Working Group concluded that drinking very hot beverages (> 65 °C) is *probably carcinogenic to humans* (Group 2A) based on epidemiological studies showing *limited evidence* of a causal association with cancer of the oesophagus in humans and *limited evidence* in experimental animals. The Working Group noted that a causal relationship between consuming very hot beverages and cancer of the oesophagus is biologically plausible through mechanisms linking thermal injury to cancer. Drinking mate that is not very hot was classified in Group 3 (*not classifiable as to its carcinogenicity to humans*).

References

IARC (1991). Coffee, tea, mate, methylxanthines and methylglyoxal. *IARC Monogr Eval Carcinog Risks Hum*, 51:1–513. Available from: http://monographs.iarc.fr/ENG/Monographs/vol51/index.php PMID:1674554

Loomis D, Guyton KZ, Grosse Y, Lauby-Secretan B, El Ghissassi F, Bouvard V, et al.; International Agency for Research on Cancer Monograph Working Group (2016). Carcinogenicity of drinking coffee, mate, and very hot beverages. *Lancet Oncol*, 17(7):877–8. doi:10.1016/S1470-2045(16)30239-X PMID:27318851

Straif K, Loomis D, Guyton K, Grosse Y, Lauby-Secretan B, El Ghissassi F, et al. (2014). Future priorities for the IARC Monographs. *Lancet Oncol*, 15(7):683–4. doi:10.1016/S1470-2045(14)70168-8