

# Preparing Meal in Microwave Oven or Drinking Water of Single-Use Bottles on a Daily Basis May Be Associated with an Increased Risk of Early-Onset Colorectal Cancer

Tamás Kullmann<sup>1,2\*</sup>, Sára Pihokker<sup>2</sup>, Rózsa Mészáros<sup>1</sup>, Edit Angi<sup>1</sup>

<sup>1</sup>Department of Oncology, Saint Barbara Hospital, Bánhida, Hungary

<sup>2</sup>Department of Oncology, Petz Aladár Hospital, Győr, Hungary

Email: \*kullmann@doki@hotmail.com, sarapihokker@gmail.com, drmeszaros.rozsa@gmail.com, angi.edit@gmail.com

**How to cite this paper:** Kullmann, T., Pihokker, S., Mészáros, R. and Angi, E. (2026) Preparing Meal in Microwave Oven or Drinking Water of Single-Use Bottles on a Daily Basis May Be Associated with an Increased Risk of Early-Onset Colorectal Cancer. *Journal of Cancer Therapy*, 17, 197-203.

<https://doi.org/10.4236/jct.2026.173019>

**Received:** February 25, 2026

**Accepted:** March 14, 2026

**Published:** March 17, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

**Background:** The incidence of early-onset colorectal cancer has been increasing worldwide for 10 years. The reasons why colorectal cancer has recently been touching younger adults are not clarified. **Materials and Methods:** 17 early-onset colorectal cancer patients treated at two regional oncology centers were requested to fill a dietary questionnaire. Patients were asked to indicate the highest frequency with which they were practicing 12 different dietary habits for at least 3 years preceding the diagnosis of the colorectal cancer, going from daily routine, by weekly, monthly or more rarely routine up to never. **Results:** 15 patients reported they had been preparing meals in microwave oven and 8 reported they had been drinking water from single-use bottles on a daily basis. 7 patients reported they had been practicing both of these habits. 1 patient did not report the daily practice of any of the proposed habits. **Conclusions:** These preliminary data suggest that preparing meal in microwave oven or drinking water of single-use bottles on a daily basis may be associated with an increased risk of early-onset colorectal cancer. More extensive socio-anthropologic investigations are required in addition to ongoing *in vivo* and *in vitro* biological research to confirm this hypothesis.

## Keywords

Early-Onset Colorectal Cancer, Microplastic, Microwave Oven, Water Bottle

## 1. Introduction

The increasing number of young adults diagnosed with colorectal cancer has

astonished us as medical oncologists and a dietician. According to the Global Burden of Diseases 2019 database, colorectal cancer, traditionally considered as a disease of the older age, had the third highest incidence and mortality rate among young adults globally (with 2.5 and 0.9 per 100.000 respectively [1]). The recent work of Sung *et al.* found an increasing incidence of early-onset colorectal cancer (eoCRC) in 27 out of the 50 investigated countries during the last 10 years [2], thus confirming our personal experience at a global scale. Moreover, they observed that the incidence of eoCRC had been increasing despite the stability or even decrease in the incidence of CRC in the whole population in most of the countries (Colorectal cancer being referred as early-onset in case the diagnosis is established before the age of 50).

Hereditary factors such as Lynch syndrome or familial adenomatous polyposis do not account for more than 20% of the cases of eoCRC [3] and they certainly do not explain the sharp increase in incidence. For the majority of the cases, the causes of eoCRC are not clarified. Aria, an artificial intelligence developed by the European Union, suggests that lifestyle factors (obesity, high consumption of red and processed meat, sugary drinks, alcohol, smoking) and gut microbiome disruption may play a role in the development of eoCRC.

We hypothesized that 1) the increased incidence of colorectal cancer was in relation with some so far unidentified dietary regime and 2) the risk of this regime must be high enough to be detectable in a small-scale survey.

## 2. Patients and Methods

Based on these assumptions, we performed a dietary questionnaire with 17 eoCRC patients, treated between 1<sup>st</sup> October 2024 and 30<sup>th</sup> September 2025 at the Departments of Oncology of the Petz Aladár and the Saint Barbara Hospitals in Hungary. Patients had to indicate the highest frequency with which they were practicing 12 different dietary habits for at least 3 years preceding the diagnosis of the colorectal cancer, going from daily routine, by weekly, monthly or more rarely routine up to never.

The 12 items were as follows: 1) I eat in fast food restaurants. 2) I use microwave oven and put the meal in porcelain or glass containers. 3) I use microwave oven and put the meal in plastic containers. 4) I store meal in plastic containers. 5) I transport food in plastic bags. 6) I use plastic cutlery. 7) I drink water from single-use bottles. 8) I drink soft drinks from single-use bottles. 9) I drink tea made with tea bags. 10) I use artificial sweetener, e.g. aspartame. 11) I consume ultra-processed food, e.g. sauces. 12) I consume processed cold cuts. In addition, patients were also asked for how long they were eating in public canteens including their school age.

Patients filled the questionnaires on their own on the occasion of an outpatient visit or a session of chemotherapy. The local ethics committee approved the questionnaires. All questionnaires were returned fully completed and without corrections, suggesting that the items were formulated in an understandable way.

### 3. Results

17 eoCRC patients were included (11 men and 6 women). The average age at diagnosis was 46 years (37 - 50 years). They were diagnosed with rectosigmoid cancer in 10 cases, other left-sided CRCs in 2 cases and right-sided CRCs in 5 cases. 7 patients were non-metastatic at the diagnosis, 2 progressed shortly after the treatment of the primary tumor and 10 were diagnosed with metastatic disease. All CRCs were adenocarcinomas, 2 of them showing a BRAF mutation and 1 of them showing microsatellite instability (MSI).

One patient with Crohn's disease developing CRC was not included in the survey. No patient had a family history suggesting a hereditary syndrome or was found to have colorectal polyposis.

15 out of the 17 patients reported the daily usage of microwave oven. 8 patients reported the daily consumption of water from single-use bottles. 7 patients reported practicing both of these daily habits.

All but one person who uses microwave oven on a daily basis reported to put the meal in porcelain or glass containers while warming them, nevertheless, 12 of them either stored food in plastic containers or put it on a weekly basis in the microwave oven in plastic containers.

The fourth most frequent daily habit was the usage of tea bags, reported by 7 patients. The eating of processed cold cuts was reported by 2 patients on a daily basis and 6 patients on a weekly basis. 8 patients reported they were eating in public canteens for at least 10 years. Other dietary habits were not reported on a regular basis by more than 4 persons. 1 patient did not report the daily practice of any of the proposed habits.

### 4. Discussion

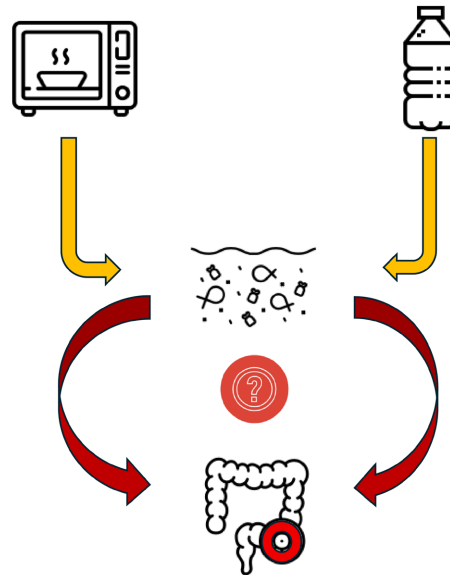
A high proportion of our eoCRC patients shared three daily habits. They were either using microwave oven for the preparation of their meal associated to storing it in plastic containers or drinking water of single-use plastic bottles.

Although exact data on the prevalence of these habits in the general population are lacking, these figures merit consideration. Microwave oven ownership in European countries is over 90% still it does not necessarily mean, all people use them on a daily basis for preparing their meal. Bottled water consumption varied between 100 - 140 l per capita per year in Hungary between 2009-2023 [4]. This means that patients who reported drinking bottled water on a daily basis consume of it over the average.

Microwave ovens are generally considered to have no major health risks, although their capacity to change food properties is recognized [5]. Still, the relation with CRC has not been closely investigated to our knowledge. A potential hazard of microwave oven use may be its association to storing food in plastic vessels as reported by the majority of our patients.

A potential link between water bottles and CRC was recently furnished by Sajedi *et al.* [6]. According to their review 90.000 more microplastic (MP) particles

were detected in individuals drinking water from single-use bottles as compared to controls. MP concentration of rectal adenocarcinoma tissue was found to be higher than that of normal colic mucosa [7] and CRC cell lines show intracellular MP uptake [8] (**Figure 1**).



**Figure 1.** Preparing meal in microwave oven or drinking water of single-use bottles on a daily basis may be associated with an increased risk of early-onset colorectal cancer via the long-term ingestion of increased amounts of microplastic particles.

MP is referred to plastic particles measuring between 1  $\mu\text{m}$  and 5 mm, whereas nanoplastics are referred to plastic particles smaller than 1  $\mu\text{m}$ . Any small plastic fragments can be ingested from plastic vessels. Although inhalation and dermal contact are also recognized ways of MP ingestion and the particles may enter the blood circulation and cross biological barriers [8], it seems to be more probable that MPs found in CRC tissue originate from oral intake.

MPs are also released from tea bags [9]. On the other hand, drinking green tea has been shown to protect against CRC [10]. When taking into account that green tea is usually prepared with loose tea and is consumed from multi-use plastic, metal or glass bottles, it may be speculated that it is not necessarily the tea that is protective but the fact of avoiding the single-use bottles and the tea bags.

Concerning other potential dietary factors, the relative risk for colorectal cancer was found to be low for processed meat [11] and no risk at all was found for aspartame [12], in line with the absence of positive answers in our survey.

The theory explaining the formation of CRC with the disruption of the intestinal microbiome is widespread [13]. Furthermore, dysbacteriosis has also been demonstrated in eoCRC patients [14]. However, it has also been proposed that MPs cause CRC via the modification of the gut microbiome [15]. Moreover, it may also be speculated that changes in microbiome and CRC formation may both

be a result of microplastic deposition without being a direct cause and effect relationship between the two.

Anyway, a dietary reason for eoCRC seems to be plausible. The trigger should be something that emerged and spread globally about 30 - 40 years ago. Therefore, snacks commercialized in the US and Europe from the 1920s up along with the introduction of paper bags and printed marketing on them were ruled out from our survey. Fast food restaurants created from the 1950s up, however, were included as they became more widespread from the 1980s in many countries. Hence, our patients did not report to eat regularly in fast food restaurants.

In addition to concerning young adults, the other deplorable reality of eoCRC is that it is often diagnosed in advanced stage. Our patient population also corresponds to this common finding. In case microplastics are really the main trigger of eoCRC, it may be forecasted that the incidence of CRC in any age is going to increase in the coming years. It also means that besides screening and polypectomising the changing of our habits will become an important issue in the prevention of CRC.

For the confirmation of this hypothesis, larger scale and deeper socio-anthropologic studies are needed besides the epidemiologic studies regarding eoCRC and the *in vitro* and *in vivo* biological research of MPs in colorectal tissues.

Concerning the perspectives of the reduction of plastic usage, the self-restriction of water and soda producing companies is as hard to imagine as the environmental consciousness of water and soda consumers. Nevertheless, the efforts of the regulatory agencies and the self-interest regarding the wish to avoid CRC risk may feed some hope.

Concerning the limitations of this pilot study, the minimal exposure window to the different dietary habits was set in the questionnaires to three years. This does not correspond to an established risk threshold. It is rather a sensitive limit that should be precised by further investigations. "Preparing a meal in microwave oven" covers reheating as well as cooking. Similarly, the relative risk of the different interventions should be precised later. Potential confounding factors such as the body mass index, the drinking and smoking habits, the history of antibiotic exposure and the socioeconomic status were not collected from the patients.

Finally, CRC is not the only potential harm of microplastic ingestion. However, the detailed presentation of the environmental and health risks of microplastics is not among the objectives of this paper. For a concise presentation of the potential harms of plastic bottles, refer to <https://www.aquasana.com/> [4].

## 5. Conclusion

These preliminary data suggest that preparing meals in microwave oven or drinking water of single-use bottles on a daily basis may be associated with an increased risk of early-onset colorectal cancer. More extensive socio-anthropologic investigations are required in addition to ongoing *in vitro* and *in vivo* research to confirm this hypothesis.

## Authors' Contribution

TK and SP established the questionnaire. All authors participated in making fill the questionnaires as well as in the management of the patients. The article was written by TK and corrections were proposed by the other authors. All authors read and accepted the final version of the manuscript.

## Funding

The work did not receive any funding.

## Conflicts of Interest

The authors have no conflict of interest in connection with the publication of this manuscript.

## References

- [1] GBD 2019 Adolescent Young Adult Cancer Collaborators (2022) The Global Burden of Adolescent and Young Adult Cancer in 2019: A Systematic Analysis for the Global Burden of Disease Study 2019. *The Lancet Oncology*, **23**, 27-52.
- [2] Sung, H., Siegel, R.L., Laversanne, M., Jiang, C., Morgan, E., Zahwe, M., *et al.* (2025) Colorectal Cancer Incidence Trends in Younger versus Older Adults: An Analysis of Population-Based Cancer Registry Data. *The Lancet Oncology*, **26**, 51-63. [https://doi.org/10.1016/s1470-2045\(24\)00600-4](https://doi.org/10.1016/s1470-2045(24)00600-4)
- [3] Mayo Clinic Staff (2025) Early-Onset Colon Cancer. <https://mayoclinic.org/diseases-conditions/colon-cancer/in-depth/early-onset-colon-cancer/art-20583551>
- [4] Bottled Water Market Size Volume Per Capita in Hungary. <http://www.reportlinker.com/dataset/c39b272e8fb01c4df9e525a633966451e9cb5adb>
- [5] Deng, X., Huang, H., Huang, S., Yang, M., Wu, J., Ci, Z., *et al.* (2022) Insight into the Incredible Effects of Microwave Heating: Driving Changes in the Structure, Properties and Functions of Macromolecular Nutrients in Novel Food. *Frontiers in Nutrition*, **9**, Article ID: 941527. <https://doi.org/10.3389/fnut.2022.941527>
- [6] Sajedi, S., An, C. and Chen, Z. (2025) Unveiling the Hidden Chronic Health Risks of Nano- and Microplastics in Single-Use Plastic Water Bottles: A Review. *Journal of Hazardous Materials*, **495**, Article ID: 138948. <https://doi.org/10.1016/j.jhazmat.2025.138948>
- [7] Cetin, M., Demirkaya Miloglu, F., Kilic Baygutalp, N., Ceylan, O., Yildirim, S., Eser, G., *et al.* (2023) Higher Number of Microplastics in Tumoral Colon Tissues from Patients with Colorectal Adenocarcinoma. *Environmental Chemistry Letters*, **21**, 639-646. <https://doi.org/10.1007/s10311-022-01560-4>
- [8] Wen, J. and Lin, Y. (2025) Invisible Invaders: Unveiling the Carcinogenic Threat of Microplastics and Nanoplastics in Colorectal Cancer—A Systematic Review. *Frontiers in Public Health*, **13**, Article ID: 1653245. <https://doi.org/10.3389/fpubh.2025.1653245>
- [9] Yaroslavov, A.A., Efimova, A.A., Grokhovskaya, T.E., Badikova, A.G., Spiridonov, V.V., Pozdyshev, D.V., *et al.* (2025) Evolution of Microplastics Released from Tea Bags into Water. *Polymers*, **17**, Article No. 2700. <https://doi.org/10.3390/polym17192700>

- 
- [10] Yang, G., Zheng, W., Xiang, Y., Gao, J., Li, H., Zhang, X., *et al.* (2011) Green Tea Consumption and Colorectal Cancer Risk: A Report from the Shanghai Men's Health Study. *Carcinogenesis*, **32**, 1684-1688. <https://doi.org/10.1093/carcin/bgr186>
- [11] Wu, S., Shan, S., Wang, Z., Gan, R., Zhang, S., Yang, Y., *et al.* (2025) Beyond the Plate: Unveiling the Association between Meat Consumption and Colorectal Cancer Risk. *Journal of Gastroenterology and Hepatology*, **41**, 429-442. <https://doi.org/10.1111/jgh.70210>
- [12] Zhu, C., Ji, D., Ma, J. and Da, M. (2023) Association between Artificial Sweetener-Aspartame Consumption and Colorectal Cancer Risk: Evidence-Based Strategies. *Oncology*, **102**, 533-543. <https://doi.org/10.1159/000534812>
- [13] Fan, Y., Gu, X., Yang, H., Chen, Y., Fang, C., Deng, H., *et al.* (2025) Intratumoral Microbiome: A Crucial Regulating Factor in Development and Progression of Colorectal Cancer. *Molecular Biomedicine*, **6**, Article No. 138. <https://doi.org/10.1186/s43556-025-00376-2>
- [14] Lauricella, S., Brucchi, F., Cirocchi, R., Cassini, D. and Vitellaro, M. (2025) The Gut Microbiome in Early-Onset Colorectal Cancer: Distinct Signatures, Targeted Prevention and Therapeutic Strategies. *Journal of Personalized Medicine*, **15**, Article No. 552. <https://doi.org/10.3390/jpm15110552>
- [15] Deng, J., Zhou, Y., Zhang, Y., Zhou, C. and Fang, J. (2025) The Relationship between Gut Microbiota, Lifestyle Habits, and Early-Onset Colorectal Cancer: Shedding Light on Early Prediction. *British Journal of Cancer*, **134**, 469-476. <https://doi.org/10.1038/s41416-025-03277-x>