

Agricultural and Industrial Carcinogens as Cancer Resulting: Part I

Larysa Karaliova, Ilia Brondz

Norwegian Drug Control and Drug Discovery Institute (NDCDDI) AS, Ski, Norway
Email: larysa.karaliova@gmail.com, ilia.brondz@gmail.com

How to cite this paper: Karaliova, L., & Brondz, I. (2025). Agricultural and Industrial Carcinogens as Cancer Resulting: Part I. *Voice of the Publisher*, 11, 609-624.
<https://doi.org/10.4236/vp.2025.114040>

Received: October 9, 2025

Accepted: November 25, 2025

Published: November 28, 2025

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Abstract

This is a paper in a series of reviews that discusses agricultural and industrial carcinogens and cancer resulting from the ingestion of carcinogens in food and pharmaceutical formulations. The article examines agricultural, industrial, and consumer-product carcinogens-dioxins, mycotoxins, radioactive isotopes, and chemically unstable food or supplement formulations as major contributors to the rising global incidence of malignant disease. Based on historical and regulatory evidence, it argues that profit-driven policies and administrative negligence allow mutagenic and endocrine-disrupting compounds to persist in human food chains and pharmaceuticals. A cross-disciplinary review of toxicology, environmental chemistry, and epidemiological data indicates that both industrial residues and uncontrolled nutritional additives contribute to long-term genotoxicity and cancer risk. The following series of essays will present the infections and helminths invasions, the medical approach to the problem, the main methods of medical analyses and treatment, and their usefulness and harmfulness for patients. Also examined are the health care and medical structure in Norway as an existing model for most developed countries, and many other aspects relating to the increase in the incidence of cancer.

Keywords

Agricultural and Industrial Carcinogens, Cancer, Carcinogens in Pharmaceutical Formulations

1. Introduction

Manmade social, agricultural, and industrial progress is not always compatible with safety related to human health. Combining traditional practices with modern developments can often compromise health security and may not always yield positive results; in fact, it can sometimes be harmful or even criminal (Brondz, 2017).

Carcinogenic exposure in agriculture and industry has been a continuing challenge throughout the 20th and 21st centuries. Persistent organic pollutants, synthetic fertilizers, industrial solvents, and poorly controlled additives have created a biochemical environment that undermines public health.

In many cases, contamination results not only from industrial waste but also from defective design in consumer formulations, where the combination of vitamins, trace metals, and excipients promotes oxidative stress instead of preventing it.

Methodology of Literature Review:

The present review was based on publications retrieved between 1910 and 2024 from the databases PubMed, Scopus, and Web of Science, using search terms such as “*dioxin AND cancer risk*”, “*mycotoxin exposure*”, “*radioactive fallout AND epidemiology*”, “*trace metals and supplement toxicity*,” and “*vitamin formulations carcinogenesis*”. Official regulatory reports from the World Health Organization (WHO), European Food Safety Authority (EFSA), ICRP, and UNEP were also consulted. Inclusion criteria focused on peer-reviewed studies, meta-analyses, and government toxicological assessments that directly described exposure-response relationships or mechanistic evidence of carcinogenicity. This transparent approach ensures reproducibility and balances historical context with current scientific data.

2. Ancient Evidence about the Disease

The ancient Egyptian medical text, the Edwin Smith Papyrus, described medical cases from mummified humans (Tondini, Isidro, Camarós, 2024). Comprehending the prevalence of cancer in ancient Egypt is challenging. Currently, various cancers, from leukemia to colorectal cancer, are known under the common name of cancer. The Edwin Smith Papyrus dates from 3000-2500 BC, approximately 5000 years ago, and life conditions in the context of food preparation and exposure to toxins and xenobiotics were rather different at that time. However, common hazards, such as those prevalent during industrialization, could have existed even in ancient times.

3. Agricultural and Industrial Interests

Agricultural and industrial interests are pushing the governmental authorities in all countries to present explanations to the mass media regarding the rising number of diseases, accompanied by evidence of secondary importance, such as smoking tobacco and drinking alcohol. Often, the mass media present no real evidence about the core sources for the basis of such diseases. Smoking tobacco and drinking alcohol are blamed by the mass media as the main culprits for the appearance of cancer. The present situation is similar to that in the mid-80s in Norway during the “Stor Norsem Saken” (in English: “The Great Norsem Case”), when a main reason for lung cancer among workers, according to “*expert judgment*” in court, was not asbestos exposure, but tobacco and alcohol. Due to the absence of verbatim or detailed reports during the process, only general records are available: “I

1982 anla i alt 31 arbeidstakere og etterlatte...Etter rettsforhandlinger høsten 1983, ble det inngått forlik” (in English: “In 1982, a total of 31 workers and survivors...After court proceedings in the autumn of 1983, a settlement was reached.”) (Norges Offentlige Utredninger, 1994).

Mass media even present fraudulent publications about different medical drugs in medical journals. “*Involvement of the pharmaceutical industry in false publications about drug quality via bribery of scientists with low ethics and those who work at lower-tiered institutions has also been described*” (Brondz, 2015). The scientific publishing giant: “*Elsevier published 6 fake journals. Scientific publishing giant Elsevier put out a total of six publications between 2000 and 2005 that were sponsored by unnamed pharmaceutical companies and looked like peer reviewed medical journals, but did not disclose sponsorship, the company has admitted. Elsevier is conducting an ‘internal review’ of its publishing practices after allegations came to light that the company produced a pharmaceutical company-funded publication in the early 2000s without disclosing that the ‘journal’ was corrupt.*” (Written by Grant, 2009) Similar publications were in other cases “*GSK Fined £300 Million for China Corruption*” (Jia, 2014), and “*China Fines GlaxoSmithKline Nearly \$500 Million in Bribery Case*” (Bradsher & Buckleysept, 2014) published in *The New York Times* on September 19, 2014.

3.1. Agricultural Contaminants and Food Chain Exposure

Among the most persistent agricultural carcinogens are dioxins, furans, polychlorinated biphenyls (PCBs), and mycotoxins produced by *Aspergillus* and *Fusarium species*. Contamination of grains, oils, and animal feed introduces cumulative exposure even in trace concentrations. According to EFSA (2023), dioxin levels in certain animal-derived foods remain above the tolerable weekly intake of 2 pg WHO-TEQ/kg bw, especially in fatty fish and smoked meat. These exposures are particularly relevant for rural populations consuming self-produced food. Earlier anecdotal comparisons, such as equating a tin of smoked sardines to several packs of cigarettes, are non-quantitative. EFSA’s validated data show that polycyclic aromatic hydrocarbons (PAHs) in heavily smoked fish can reach 1 - 2 µg/g, comparable to the benzo[a]pyrene content in moderate tobacco exposure per day.

3.2. Industrial and Environmental Carcinogens

Industrial activities such as metal refining, waste incineration, and pesticide manufacturing emit radionuclides, heavy metals (As, Cd, Hg), and dioxin-like compounds that bioaccumulate in soil and water. Following atmospheric nuclear testing and large-scale industrial combustion during the 1950s-1980s, background radionuclide contamination remains measurable (ICRP, 2024), and UNSCEAR (2024) confirms that long-lived isotopes such as Cs-137, Sr-90, and Pu-239 persist in ecosystems and human tissues, with epidemiological evidence linking chronic exposure to thyroid, breast, and hematologic cancers even at low doses.

3.3. Agricultural Production of Food with a High Risk for Developing Cancer

The growing global population requires food. The stability of every government and regime depends on the availability of food to the population. The global prices of food had increased by 40% by the end of 2010. *“By late 2010, global food prices had increased by 40% over the year, largely due to drought and wildfire in grain-exporting regions of Russia and Eastern Europe, as well as unprecedented floods in grain-importing Pakistan.”* And *“One of the most important events over the past decade has been the Arab Spring of 2011 that brought down dictators in Tunisia, Libya, Yemen, and Egypt, and continues to reverberate through the region.”* (Holland, 2012)

The combined use of traditional old and modern technologies has created poisonous agricultural foods and led to toxins in agricultural production: *“The habit of burning old grass, stubble, and debris possibly originated from Australian Aborigines or because the ashes of forests burned by new settlers in Europe and America in the subsequently cultivated field gave the best harvest in the first year. This custom persists to the present day in India, many African countries, ...”*, and *“Burning the stubble and debris on the fields after harvesting the crops implies that residuals of fertilizers and pesticides are also being burned and released into the air.”* And *“Chlorophenoxy acids and their esters are used for the cultivation of tobacco and cereals.”* ... *“The temperature of the fires burning the stubble and debris in the fields is about 700°C - 750°C.”* *“This is the exact temperature needed for the conversion of chlorophenoxy acids to dioxins.”* (Brondz, 2017) Thus, this process leads to the contamination of agricultural products, such as cereals, tobacco, fruits, milk, meat, eggs, and poultry, with dioxins (Malisch & Kotz, 2014). The consumption of food contaminated by dioxins presents a high risk for developing cancer, especially colorectal cancer, and smoking tobacco contaminated with dioxins can lead to lung cancer (Gonzalez & Domingo, 2021; Birnbaum, 1994; Schwarz & Appel, 2005; Li, Chen, Tsai et al., 2015; Ott & Zober, 1996; Danjou, Fervers, Boutron-Ruault et al., 2015; EFSA, 2023).

Thousands of precancerous and cancerous cells are present in every human body. However, a strong immune system prevents the development of tumors from these cells. Many pesticides have been shown to jeopardize the immune system (Brondz & Brondz, 2011).

The industrial collection of food waste plays a role in keeping cities clean. However, the industrial processing of food waste for animal forage contributes to a significant increase in the development of cancer, specifically that of colorectal cancer. The industrial collection of food waste and its processing into forage for animals and fish should be assessed, starting from the initial stages. The green movement should also be included in this assessment because it initiated the popularity of organic food. Organic crops and forage should be produced, i.e., without the use of chemical fertilizers and pesticides, which are harmful and contain toxic substances from processing. Before the invention of chemical fertilizers and pes-

ticides, pigs' and other farm animals' manure was used as a natural fertilizer. Currently, farm animals are not always fed with organic forage; therefore, xenobiotics, pesticides, and antibiotics, together with viruses, bacteria, and helminths, are often present in the farm animals' manure. Viruses, bacteria, and helminths are frequently present in swine manure (Brondz, 2018; Salim, Masroor, & Parween, 2020). Moreover, household food waste is processed into forage for animals and fish and contains xenobiotics, pesticides, fertilizers, preservatives, stabilizers, antibiotics, and many other additives from industrial and agricultural production. An example is of household food waste presented in **Figure 1**. This leads to an increase and accumulation through the cycling of toxins in the animals, manure, soil, and crops.



Figure 1. Example of household food waste.

Organic foods can be contaminated with even more toxins, including mycotoxins, which promote cancer development. After their harvesting, the bulk transport and sorting of food products take 1 - 2 days each. Moreover, transporting most vegetables and fruits from warm countries to Europe takes a minimum of 2 weeks (including loading and unloading), sorting again after unloading takes 1 - 2 days, taxation processes and distribution to bulk buyers takes 1 - 2 days, and distributing to markets and shops also takes 1 - 2 days. Thus, vegetables and fruits are stored for approximately 3 weeks before reaching the consumers. Fungi, molds, and yeasts begin growing on vegetables and fruits, even though they are not detectable by visual inspection. Their processing in the kitchen and delivery to the table can take from 1 to several days. All mycotoxins produced will be eaten, but it is only a small fraction of all mycotoxins that are consumed by humans. The authors will not address the problem of some cheeses, such as Roquefort cheese, and meats processed using *Penicillium roqueforti*. The authors nevertheless note that one of the mycotoxins produced by *P. roqueforti* is penicillic acid, which is mutagenic and can cause DNA single-strand breaks, chromosome aberrations, and inhibition of

DNA synthesis.

Most mycotoxins are produced during the storage of kitchen waste in containers before they are collected by communal services and transported to the processing plants for the manufacturing of forage for animals, poultry, and fish. This usually takes 2 weeks, during which fungi, molds, and yeasts grow rapidly and produce toxins.

Toxins such as aflatoxins and mycotoxins are highly toxic carcinogens. *Aspergillus flavus* and *Aspergillus parasiticus* are the main fungi that produce aflatoxins (WHO, 2023).

Aflatoxin-producing fungi contaminate crops in the field, at harvest, during storage (especially long-term storage), and during the industrial manufacturing of forage for animals, poultry, and fish. Such industrially processed forage from remains of food contaminated with aflatoxins B1, B2, G1, and G2 in the case of crops, and M1 in the case of milk. Exposure to aflatoxins increases the risk of liver cancer (Salim, Masroor, & Parween, 2020; Claeys, Romano, De Ruyck et al., 2020).

Hundreds of different mycotoxins, such as ochratoxin A, patulin, fumonisins, zearalenone, nivalenol, and deoxynivalenol, have been identified. All aflatoxins and mycotoxins are thermostable molecules and cannot be destroyed by the temperature or fermentation processes used during the industrial production of forage for animals, poultry, and fish. Feeding animals, poultry, and fish with forage contaminated with toxins leads to the accumulation of these toxins in meat, eggs, fish products, and milk. The swine manure used as fertilizer also contains these toxins. This is a cyclic process in which the concentration of toxins continues to increase (Brondz, 2018; Brondz, 2020; Salim, Masroor, & Parween, 2020; Claeys, Romano, De Ruyck et al., 2020).

3.4. Radiation Exposure, Fishing, and Fish Farming

Another example of toxic food is contaminated fish and fish farming products with radioactive waste. Fish is an essential food item in many countries and a significant source of protein intake for populations in Japan, Norway, Sweden, and China.

Sardines, trout, salmon, and herring, which are called fatty fish, have polyunsaturated acids, and tuna fish has all the essential amino acids that are beneficial for health and cancer prevention.

A partial meltdown of reactors and repeated release of radioactive materials into the atmosphere and sea occurred at the Fukushima-1 Daiichi nuclear power plant on March 11, 2011, after a catastrophic earthquake and tsunami. The California Coastal Commission reported: “*Several large pulses of radionuclides were released into the atmosphere in the first week after the tsunami, coinciding with explosions and fires in multiple Fukushima reactor buildings.*” and “*A small fraction reached the West Coast within 4 - 7 days of the accident, resulting in detectable levels of airborne radioactivity in California. Airborne radionuclides, in particular iodine-131, cesium-134 and cesium-137, were partially transferred to the*

land surface through fallout, ...” and “Radioactive cesium derived from Fukushima has been detected at low levels in the tissues of highly-migratory fish species such as Pacific Bluefin tuna, which appear to have accumulated the cesium in their juvenile rearing grounds in the western Pacific.” and “The primary release of radioactivity to the atmosphere occurred within a week of the accident, from March 12 - 18, 2011, with subsequent releases occurring in much smaller amounts. Estimates of the total atmospheric release range from 11,500 to >20,000 peta Becquerels (PBq, 10¹⁵ Bq); ...”, and “Generally speaking, levels of radioactivity in marine organisms will be proportional to the radioactivity of the water in which they live, with higher levels expected in organisms dwelling closer to the source of contamination. However, certain radionuclides which are chemically similar to nutrient elements can be preferentially absorbed by marine organisms and become concentrated in the marine food web.” and “The canonical, precautionary view, which extrapolates from studies of the health impacts of high doses of radiation, is that any increment of increased radiation exposure, no matter how small, increases an individual’s chance of developing cancer or other health problems, and that even unavoidable natural background radiation can contribute to health problems (53).” (ICRP, 2024; California Coastal Commission, 2014; Buesseler, 2014; Buesseler, Aoyama, & Fukasawa, 2011) The Fukushima-1 Daiichi nuclear power plant disaster was not the first one; the Chernobyl Nuclear Power Plant disaster occurred in 1986. More than 6000 cases of childhood thyroid cancer occurred within the affected populations (Steinhauser, Brandt, & Johnson, 2013). Several radioactive nuclear leaks have been documented in the United Kingdom, including a fire at a military plutonium reactor in Windscale, Cumbria, in 1957, which led to radioactive contamination over large parts of England and Europe: “Windscale, Cumbria, 1957: Fire at a military plutonium reactor spread radioactive contamination over large parts of England and Europe...” (Morelle, 2007; Lorna, 1995). Other incidents include the leakage of radioactive particles from old reactors in Dounreay, Caithness, which contaminated the shoreline and seabed during 1963-1984: “Tens of thousands of radioactive particles from old reactors contaminated the shoreline and the seabed...” (Edwards, 1995) and “Chapel Cross, Dumfriesshire, 2000-2005: 126 radioactive particles from defunct reactors found on the shore of the Solway Firth...” (Edwards, 1995; Edwards, 2011).

The main source of technetium-99 (⁹⁹Tc) emissions was the Sellafield plant (UK). Dozens of terabecquerels (TBq) of ⁹⁹Tc are dumped into the sea every year. More than 200 TBq were dumped into the sea every year during the 1990s. This caused a sharp increase in ⁹⁹Tc concentrations in marine waters off the coast of Norway. Half-life of ⁹⁹Tc is 213,000 years. The chemical form of the pertechnetate anion (TcO₄⁻) is very mobile and does not bind strongly to sediments; thus, it is easily transported by ocean currents. ⁹⁹Tc produced by fuel processing at the Sellafield plant in the 1990s was transported by currents across the North Sea to Norwegian coastal waters, where it was recorded in seawater and biota (Stralevern Rapport, 2003; Rudjord, 1998; Gwynn et al., 2004).

During 1997-2001, *Fucus vesiculosus* along the Norwegian coast had ^{99}Tc levels between 80 and 320 Bq/kg. In 2001-2005, it was confirmed that *Homarus gammarus* had a high accumulation of ^{99}Tc (Barnaby & Boeker, 2007; Lindahl, Ellmark, Gäfvert et al., 2003; Gwynn et al., 2004). The radioactive poisoning in seawater and biota was in the Irish Sea (Preston, Dutton, & Harvey, 1968), and because the Gulfstream divides into several streams, one of these streams flows into the Baltic Sea and affects this area. Death due to cancer resulting from the radiation of sea products was detected among Swedish fishermen (Mikoczy & Rylander, 2009). Possibly, not all fish in the Baltic Sea are edible. A similar situation may apply to all fish in the Irish Sea, Baltic Sea, Norwegian Coastal Areas, Norwegian Arctic waters, Barents Sea, Kara Sea, Greenland Sea, and throughout Antarctic waters up to the Bering Strait. The radioactive contamination affected cancer and death incidence in cohorts of Swedish fishermen and their wives (Mikoczy & Rylander, 2009; Turunen, Verkasalo, Kiviranta et al., 2008). The most exposed areas are those along the Gulfstream, including Norway, Sweden, and Denmark. Following European Cancer Inequalities Registry (2023): “*Estimated cancer incidence rates are higher in Norway than in the EU, ... The most common cancer types are similar to those in EU countries (prostate, breast, colorectal, melanoma and lung)*” and “*Cancer has been the leading cause of death in Norway since 2017*”, and “*Norway has one of Europe’s highest estimated cancer incidence rates, with notably higher rates for melanoma, and colorectal cancer.*”

“*Projections indicate that 40% of Norwegians will develop cancer by the age of 80.*” (European Cancer Inequalities Registry, 2025)

3.5. Synthetic Supplements and Chemical Interactions

Modern multivitamin and mineral formulations often combine transition metals (Fe^{2+} , Cu^{2+} , Mn^{2+}) with ascorbic acid, tocopherols, and unsaturated oils in a single matrix. Under aerobic storage or intestinal conditions, these mixtures undergo Fenton-type reactions, producing hydroxyl radicals ($\cdot\text{OH}$) that initiate lipid peroxidation and DNA strand breaks.

Experimental *in vivo* studies (Chen et al., 2022; Shen et al., 2021; Campbell et al., 2023) demonstrate mutagenic and inflammatory effects from such oxidative cascades, supporting the hypothesis that certain supplement designs can act as pro-oxidant carcinogenic systems rather than protective ones.

3.6. Information on Advertising about, and Formulation of, Food Additives and Vitamins

Currently, in magazines and publications for the general public and on YouTube channels, some information on vitamins and food additives includes claims that certain products are highly recommended for preventing cancer. There are many misleading and harmful descriptions of the content of the products, which are often harmful (Figure 2).



Figure 2. Misleading and harmful descriptions of the content of the products. This is a mixture of 13 vitamins and 9 minerals, manufactured in the United Kingdom for Takeda AS, Asker, Norway, manufacturer do not present on the label.

It is as presented in some formulation mixtures such as vitamin A (retinol), D (calciferol), E (tocopherol), K (phyloquinone [vitamin K1] and menaquinones [such as MK-4 and MK-7]), C (ascorbic acid), B1 (thiamine), B2 (riboflavin), B6 (pyridoxine), B12 (cobalamin), niacin, folic acid, biotin, pantothenic acid, magnesium oxide (MgO), ferrous fumarate, zinc oxide (ZnO), manganese sulfate (MnSO₄), copper sulfate (CuSO₄), potassium iodide (KI), sodium molybdate (Na₂MoO₄), and sodium selenate (Na₂SeO₄) are more harmful than useful. CuSO₄ is one of the strongest emetics (vomiting agents).

In this review, only a restricted number of reactions between anions, cations, and their reactions are described. A description of all reactions between cations (metals, metalloids, anions, and vitamins) is not possible in this short review. The pH in the stomach is highly acidic (pH = 1 - 2). In an acidic aqueous environment, ascorbate and fumarate are mainly complexing or chelating agents for multivalent metals.

Mo(VI) can catalyze the oxidation of ascorbate to dehydroascorbate/dehydroascorbic acid, which is the major oxidized form of ascorbic acid. Traces of Cu and Fe can catalyze the oxidation of ascorbate, especially in acidic environments, and Mo(VI) can further participate in or enhance this catalytic oxidation process. Fe²⁺ can be converted to a complex with ascorbate/fumarate; ascorbate supports Fe in the form of Fe²⁺ by reducing Fe³⁺ to Fe²⁺. However, oxygen is always present in the stomach, although in restricted amounts. In the presence of O₂, ascorbate is autooxidized to form H₂O₂ and Fe²⁺ to Fe³⁺ in the redox cycle. Ascorbate, Cu²⁺, and Fe²⁺ can initiate a Fenton reaction (Fe²⁺ + H₂O₂ → ·OH). Cu²⁺ forms the strongest complexes with ascorbate and catalyzes the oxidation of ascorbate: rapid reduction of Cu²⁺ → Cu⁺, then ascorbate to dehydroascorbate, and O₂ → H₂O₂. That is, Cu sharply enhances the pro-oxidant redox cycle of ascorbate (Chen,

Song, Pantopoulos, Wei, Zheng, & Luo, 2022; Campbell, Uttinger, Barth, Paulson, & Kalberer, 2023).

Bioavailability is an important factor as Zn^{2+} , Fe^{2+} , Mn^{2+} , and Mg^{2+} compete for transport and absorption. The coadministration of these ions, especially Zn and Fe, can reduce absorption. The presence of Cu^{2+} together with ascorbate increases the oxidation potential of the solution. The oxidation of ascorbate by rapid reduction of Cu^{2+} to Cu^+ , then that of ascorbate to dehydroascorbate and O_2 to H_2O_2 , and the appearance of the reaction $Fe^{2+} + H_2O_2$ and $\cdot OH$ in the stomach, H_2O_2 and $\cdot OH$ have harmful effects and can be the reason for developing cancer. In the mixture, minerals and vitamins with polyene chains are extremely sensitive to radicals. Fe^{2+} and $Cu^+ + O_2$ and $\cdot OH$ can initiate lipid peroxidation. Vitamins with polyene chains can form lipid hydroperoxides (ROOH) (Brondz, 2002), which can further decompose into aldehydes, which are toxic products. Vitamin B12 (cobalamin) can be reduced by ascorbate and interacts with oxygen, participating in adverse radical reactions. The metalloids, anions, and vitamins can react in this mixture by creating harmful and poisonous substances for the body and accelerating the appearance of cancer, or can even cause cancer. Selenate, in combination with ascorbate and iodide, creates a chain of regenerative reactions, iodine release, and the formation of selenite (SeO_3^{2-}), which is toxic to cells (US Food and Drug Administration, 2013).

3.7. Historical Example: Potassium Bromate as a Technological Carcinogen

The case of potassium bromate ($KBrO_3$) illustrates how industrial chemistry can introduce carcinogens into the food chain under the guise of “technological improvement.” Since the 1910s, potassium bromate has been widely used as a flour improver and dough-strengthening agent in bakery production. It enhanced gluten elasticity and improved crust colour but acted as a strong oxidizer capable of generating reactive oxygen species during thermal processing. Animal studies throughout the 1980s demonstrated that bromate induces renal cell tumors, thyroid adenomas, and DNA strand breaks (Kurokawa et al., 1990; WHO, 2023). In response to this evidence, the compound was progressively banned in food production: in the European Union (Directive 95/2/EC, 1990s), in Canada and the UK (1990), in Japan, where its use is permitted only if the final product contains *zero residual* bromate, and later restricted by the FDA, after voluntary withdrawal by major U.S. producers. According to the International Agency for Research on Cancer (IARC, 2011), potassium bromate is classified as Group 2B—possibly carcinogenic to humans. Its persistence in industrial baking practices in some non-EU countries illustrates the continuing risk of profit-driven disregard for toxicological evidence.

This historical precedent underlines the importance of scientific vigilance and transparent regulation—key themes throughout this review (Kurokawa, Maekawa, Takahashi, & Hayashi, 1990).

4. Discussion and Regulatory Comparison

Historically, industrial and agricultural emissions of dioxins and radionuclides were higher than they are today. However, even current regulatory limits may not eliminate chronic low-dose exposure when combined from multiple sources. For example, EFSA's TWI for dioxins (2 pg/kg bw/week) is still exceeded in some fish and dairy products, while mycotoxin contamination remains uncontrolled in the global grain trade (WHO, 2023). Further research should differentiate toxic synergism (metal-vitamin oxidation) from mere nutritional overdose to close the evidence gap.

5. Conclusion

Cancer prevention requires interdisciplinary oversight that integrates environmental chemistry, nutrition, and public health.

Historical experience demonstrates that profit-oriented industrial practices and delayed regulation continually reintroduce carcinogens into human systems.

Transparent product testing, international data sharing, and regulatory accountability are essential to reduce exposure and prevent disease.

Vitamins and minerals should not be mixed, such as in multivitamins and mineral formulations. Ascorbate, Cu^{2+} , and Fe^{2+} should not be present together in the formulation of multivitamins and minerals because their presence together can lead to harmful effects on health and cause cancer. Zn^{2+} , Fe^{2+} , Mn^{2+} , and Mg^{2+} compete for transport and absorption, and their coadministration, especially Zn and Fe, can reduce absorption.

In mixtures of vitamins, omega-3 and omega-6, Fe, and Cu, the rate of rancidity of lipids was found to be high. Even in the presence of antioxidants, the stability of such mixtures was drastically reduced, resulting in loss of activity and the formation of oxidative products. In the presence of Fe^{2+} , Cu^{2+} , and ascorbate, radical chain processes are triggered: the formation of $\cdot\text{OH}$, $\text{O}_2\cdot^-$ and H_2O_2 to initiate peroxidation of polyunsaturated fatty acids (Campbell, Uttinger, Barth, Paulson, & Kalberer, 2023).

For patients with cancer, life expectancy depends on timely diagnosis and receiving thorough and accurate medical care. Healthy food plays a significant role in the sustainability of the body and general resistance to illness. Food contaminated with mycotoxins, radioactive isotopes, or unhealthy mixtures of vitamins with minerals can lead to carcinogenic effects. Promoting fatty fish, such as sardines, trout, salmon, and herring, because they are rich in polyunsaturated fatty acids, is correct. Salmon and herring are often consumed in smoked form. All farmed fish have high levels of mycotoxins and antibiotic residues. A single meal of such fish will not harm health significantly or at all; however, their regular consumption two to three times a week over a long period can cause health problems due to the accumulation of toxins (Kaifie & Göen, 2025), especially if the fish contains mycotoxins and accumulated isotopes. Supplementing such a meal with multivitamins of incorrect formulation may only aggravate the situation. Fish is one

example, but meat, eggs, vegetables, and fruits may also contain unhealthy contaminants. Navigating this situation is possible with accurate information from the media and effective administrative security.

Authors' Contributions

The author, Dr. Larysa Karaliova (1961-2025), was the main contributor to the conceptual foundation of this review. Karaleva Larysa (**Figure 3**) (as commonly transliterated in Belarusian and Larysa Karaliova as normally transliterated into Norwegian) was born on November 2, 1961, and passed away on January 7, 2025, in a palliative department of Ahus University Hospital after a 2-year battle with an aggressive form of colorectal cancer.

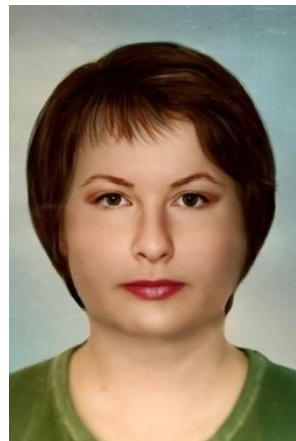


Figure 3. Dr. Karaleva Larysa.

Dr. Karaleva Larysa published a paper (Karaliova, 2015) and was a coauthor in another paper (Brondz, Karaliova, & Ekeberg, 2006). She was an Assistant Editor in Chief of the journal *Voice of the Publisher* (Brondz, 2025). Dr. Karaleva Larysa graduated from the University of Minsk in Belarus, the University of Oslo (UIO), the College of Halden Norway and the Oslo Metropolitan University, Norway, and received her degree from the Faculty of American and European Studies, History and Policy Department. She authored historical and theological studies, with a focus on the intersections of politics, history, and religion. The main text of this paper originates from her book manuscript, a project encouraged in 2011 by former French President Valéry Giscard d'Estaing, who invited her to his family residence to discuss her thesis, *La politique de Valéry d'Estaing en matière de condition féminine 1974-1981* (in French) and recommended that she write a book on American and European history, industry, and policy (Brondz, 2025).

All literature analysis, writing, and revisions were performed solely by Dr. Ilija Brondz.

Acknowledgements

The idea to publish the presented text came after the death of the main author,

Dr. Karaleva Larysa, of the book “*History and Development of American and European Politics and Industrial Progress.*”

The authors thank friends, schoolmates, and fellow students of Dr. Karaleva Larysa for their help and assistance. **Figure 3** is a photo kindly provided by the family from Larysa’s archive and Artificial Intellect for providing some useful information.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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