UDC 664.8:615.9:613.2:664.6(100) DOI: https://doi.org/10.64076/iedc250806.02

# Additives and improvers in bakery products: global trends and health risks

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***Abstract.*** *The study investigates the levels of impurities and food additives in bakery products from Ukraine, the European Union, and the United States. A comparative analysis of regulatory requirements across the three regions was conducted, and the compliance of actual sample compositions with current standards was assessed. The findings reveal that the highest deviations from European norms are observed in products from Ukraine and the United States.*
***Keywords****: bakery products, food additives, food safety, regulatory policy.*

**Introduction.** In modern mass production of bakery products, additives and improvers are widely used, affecting both technological characteristics and consumer health [1; p. 63]. These include azodicarbonamide (ADA), potassium bromate ($KBrO_3$), as well as various emulsifiers and preservatives such as BHA/BHT [2].

Ukrainian legislation, represented by the Ministry of Health and the State Food and Consumer Service, still lacks detailed monitoring of these additives in bakery products, mostly focusing on pesticides, mycotoxins, and heavy metals [3].

**Research results.** Table 1 shows the average concentrations of additives in bakery products from Ukraine, the EU, and the USA.

**Table 1.** Average concentrations (mg/kg) in bakery product

| Substance | Ukraine | EU | USA |
|---|---|---|---|
| Azodicarbonamide | 0.018 | 0.000 | 0.021 |
| Potassium bromate | 0.010 | 0.000 | 0.009 |
| Acrylamide | 0.032 | 0.015 | 0.030 |
| BHA/BHT | 0.012 | 0.006 | 0.014 |

*Source: compiled by the author*

The highest standard violations are observed in U.S. samples (74% – relative to EU standards) and Ukraine (63%). All EU samples complied with both local and EU-wide regulations.

The data confirms significant differences in the content of additives and improvers in bakery products between Ukraine, the European Union, and the United States. Particularly concerning are concentrations of ADA and $KBrO_3$, which have been linked to carcinogenic effects [4]; [5]; [6]; [7].

EU-manufactured products contain significantly lower levels of harmful additives or none at all, highlighting stricter regulatory practices. This aligns with EFSA policies that prohibit or restrict such compounds [8].

In the USA, ADA and BHA/BHT are permitted within FDA limits, though tested samples sometimes exceed Ukrainian levels. Ukraine remains in a hybrid state: substances banned in the EU, such as $KBrO_3$, are still in use despite being recognized as harmful since the 1990s.

The EU has the strictest standards, while the USA is the most lenient. Ukraine sits between both approaches, leaning towards outdated norms. Most American and Ukrainian samples failed to meet EU standards, even if they formally complied with local regulations.

Artisan and organic products contain significantly fewer or no synthetic additives. ADA and $KBrO_3$ pose the greatest risk due to confirmed carcinogenic potential.

**Table 2.** Compares regulatory limits for additives across regions

| Substance | EU (EFSA) | USA (FDA) | Ukraine (MOH, DSTU) |
|---|---|---|---|
| Azodicarbonamide (ADA) | Banned | Allowed up to 45 ppm | Partially banned (not fully monitored) |
| Potassium bromate ($KBrO_3$) | Banned since 1990s | Allowed up to 50 ppm (not in all states) | Formally banned, still used |
| BHA/BHT | Restricted (<0.002% in baked goods) | Allowed within 0.02% | Partially allowed |
| Peroxides | Banned | Allowed for flour treatment | Partially allowed |

*Source: compiled by the author.*

**Conclusions.** Significant differences were found in the content of food additives and improvers in bakery products from Ukraine, the EU, and the USA. Key findings include:

– Bakery products made in the EU are the safest chemically, due to the strictest regulatory requirements.

– Industrial products from the USA and Ukraine contain higher levels of harmful substances, confirming chronic health risks.

– Artisan and organic products showed better safety indicators regardless of origin.

Frequent consumption of bakery goods with high ADA, $KBrO_3$, and BHA/BHT levels may lead to:

– Increased cancer risk;

– Endocrine disorders;

– Impaired liver, kidney, and respiratory function.

These conclusions are based both on data from international agencies (EFSA, FDA, IARC) and on actual laboratory measurements conducted within the framework of this study.

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