

RESEARCH & DISCOVERIES

Breakfast Cereals Scrutinized for Pesticide That May Harm Reproduction

Linked to reproductive concerns, chlormequat is not approved for use on U.S. crops—however, it is entering our food supply through imports.

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4/18/2024 Updated: 8/2/2024

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Imagine starting your day with a bowl of cereal that could be silently affecting your family's health. Recent studies show that chlormequat, a pesticide linked to reproductive issues, has been found in popular breakfast cereals such as [Quaker Oats and Cheerios](#). As this substance infiltrates the U.S. food supply, the potential risks to our health and future generations loom large, raising urgent questions about the safety of our everyday food choices.

In a [study](#) published in the *Journal of Exposure Science & Environmental Epidemiology* on Feb. 15, researchers revealed alarming findings regarding the prevalence of chlormequat.

Chlormequat was detected in the urine of four out of five people, or 80 percent, of Americans tested. Additionally, 92 percent of oat-based foods tested contained chlormequat, including Quaker Oats and Cheerios.

This study—the first to report urinary chlormequat measurements in adults living in the United States—highlights the possible widespread presence of chlormequat and the necessity for transparency and further investigation into potential health implications for consumers.

What Is Chlormequat?

Chlormequat, widely known in the salt form as chlormequat chloride, is an agricultural chemical first registered in the United States in 1962 as a plant growth regulator. Plant growth regulators are chemical substances employed to control and regulate plant growth, flowering, and fruit yield, according to a [2006 study](#) in the *International Journal of Andrology*.

Chlormequat application in grain crops results in reduced stem height, thereby minimizing the occurrence of lodging (bending over), which can reduce the efficiency of the harvesting process.

Chlormequat is the world's most common plant growth regulator according to a [2020 study](#) published in *Toxicology*. "Chlormequat is often the most detected pesticide residue in grains and cereals, as documented by monitoring surveys spanning several years," according to the 2024 study. It is approved for use in Europe and parts of North America.

In the United States, chlormequat is permitted exclusively for use on ornamental plants and is prohibited for application on food crops grown within the country. Therefore, the presence of chlormequat in Cheerios and

other oat-based foods sold in the United States raises questions regarding its introduction into the food supply chain.

How Did Chlormequat Enter the US Food Supply?

In April 2018, the U.S. Environmental Protection Agency (EPA) allowed chlormequat into the food supply by establishing acceptable food tolerance levels for chlormequat chloride in imported oats, wheat, barley, and select animal products. This action allowed for the importation and sale of those agricultural products even if treated with chlormequat.

Consequently, U.S. consumers may unknowingly be ingesting tainted imported foods—potentially exposing themselves to chlormequat or its residues.

In 2020, the allowable chlormequat levels were [increased for oats](#). In April 2023, the EPA [proposed allowing](#) the first-ever use of chlormequat on barley, oat, wheat, and triticale grown in the United States. If passed, exposure levels may increase, raising concerns about its implications on health and food safety.

Health Concerns Surrounding Chlormequat

Chlormequat, while not as notorious as other pesticides, has long been linked to reproductive and developmental concerns in animal research.

In the 1980s, Danish pig farmers observed reproductive declines in pigs consuming chlormequat-treated grains, according to a [2006 article](#) in the International Journal of Andrology.

The observation led to a controlled laboratory study, which confirmed impaired reproduction. Specifically, sows fed chlormequat-treated grain experienced impaired reproduction, primarily disruptions in oestrus cycling, and difficulty mating, as cited in the 2006 article.

These findings prompted the Danish pig industry to recommend restricting the use of crops treated with chlormequat and other growth regulators (up to a maximum of 30 percent of diet energy) because of potential reproductive issues.

Similar findings were observed in 1999 when male mice exposed to chlormequat through food or drinking water demonstrated “significantly diminished fertilization and cleavage rate” of sperm, indicating a decrease in sperm function, according to [a study](#) in Reproductive Toxicology.

Of significance, the estimated intake of chlormequat in the abovementioned pig (0.0023 milligrams (mg)/kilograms (kg) body weight (bw) per day) and mouse (0.024 mg/kg bw/day) experiments fell below the reference dose published by the EPA (0.05 mg/kg bw per day) and the acceptable daily intake published by the European Food Safety Authority (0.04 mg/kg bw/day), according to the 2024 study. These findings raise concerns regarding the current established limits set by regulatory authorities.

Recent studies further demonstrate chlormequat’s reproductive and developmental toxicity, including:

- **Delayed onset of puberty:** According to a [2020 study](#) in Toxicology Letters, male rats exposed to chlormequat from postnatal day 23 to 60 demonstrated reduced prostate weight and delayed onset of puberty.
- **Reduced sperm motility:** Male rats exposed to chlormequat in utero demonstrated a delayed onset of puberty and decreased sperm motility, according to a [2021 study](#) in Toxicology Letters.
- **Decreased testosterone:** Male adult rats exposed to chlormequat by oral gavage (delivering substances directly to the stomach via a bulb-tipped needle) demonstrated lower testicular weight, decreased sperm motility, and decreased testicular testosterone, according to a [2018 study](#) in Toxicology Letters.

Moreover, developmental toxicity studies suggest that chlormequat exposure during pregnancy can disrupt fetal growth and metabolism postnatally, indicating a lasting effect on offspring development in rats. For instance, a [2020 study](#) published in Toxicology reported that maternal exposure to chlormequat in rats had adverse effects on postnatal health, including hypoglycemia, hyperlipidemia, and hyperproteinemia seven days after birth, compared with controls.

A [2007 study](#) in Analytical and Bioanalytical Chemistry reported detectable levels of chlormequat in blood, as well as its transfer into milk, in pigs exposed to chlormequat. While these markers have not been thoroughly investigated in humans, they raise concerns regarding potential implications for fetal exposure during pregnancy and infants’ exposure through breastfeeding.

Some studies have failed to detect significant effects of chlormequat on reproduction in [female mice](#) or [male pigs](#), or the fertilization capacity in [male mice](#) exposed to chlormequat during development and postnatally. The equivocal findings in the toxicological literature concerning chlormequat could stem from variations in tested doses, outcome measures, or funding sources. According to a [2006 study](#) in the International Journal of Andrology, “reports from the industry do not show any effects at these low levels.”

Aim of New Ground-Breaking Study

Considering the health concerns underscored in the scientific literature, the goal of the 2024 study was to assess the effects of the EPA’s decision to permit chlormequat in the U.S. food supply.

Study Design

The 2024 study assessed chlormequat levels in the urine of individuals from three distinct geographic regions in the United States spanning from 2017 to 2023. Specifically, 21 urine samples were gathered in South Carolina in 2017, 25 samples were collected in Missouri from 2017 to 2022, and 50 samples were obtained in Florida in 2023.

The study also examined chlormequat levels in oat- and wheat-based products acquired in the United States during 2022 and 2023. Specifically, 25 conventional oat-based food items were analyzed during this period, along with eight organic oat-based products and nine conventional wheat-based food products.

Study Results

Urine Analysis

Chlormequat was detected in 80 percent (77 out of 96) of urine samples.

The authors noted a rising trend in chlormequat exposure over time, with detection frequencies notably elevated in 2023 samples compared to those from 2017 and the years 2018 to 2022. Specifically, in 2017, 69 percent of samples tested positive, while from 2018 to 2022, 74 percent were positive. In stark contrast, 90 percent of samples in 2023 were positive, representing a significant increase from all previous years examined.

According to the researchers, "these data indicate likely continuous exposure given the short half-life of chlormequat [two to three hours]"

To assess whether the rising concentrations detected in the urine samples reflected potential dietary exposure to chlormequat, the researchers analyzed chlormequat levels in oat- and wheat-based food products purchased in the United States.

Food Exposure Analysis

The results of the food analysis were equally concerning: A high percentage of conventional oat-based products tested positive for chlormequat, with popular brands such as Quaker Oats and Cheerios among those affected.

Specifically, 92 percent (23 out of 25) of conventional oat-based products tested positive for the presence of chlormequat, "indicating a high prevalence of chlormequat in oats," according to the study. This highlights the potential risk posed to consumers, particularly children, who may consume these products regularly.

Chlormequat was detected in 12.5 percent (one out of eight) of organic oat-based products tested. Additionally, 22 percent (two out of nine) of conventional wheat-based products tested positive for chlormequat.

Collectively, the urinary and food exposure data "may reflect the likely recent introduction of chlormequat into the U.S. food supply due to EPA regulatory action changes involving chlormequat, including establishing a limit on chlormequat in food in 2018 and raising those limits for oats in 2020," according to the study.

Conclusion

This groundbreaking study sheds light on the possible widespread prevalence of chlormequat in the U.S. food supply, as documented in both urinary and food exposure analyses. The findings reveal a concerning trend of increasing chlormequat exposure over time, with detection frequencies spiking notably in recent years.

Chlormequat's documented toxicological properties, particularly its association with reproductive and developmental issues, raise significant concerns about its long-term effects on human health. Moreover, there is currently [no monitoring](#) of chlormequat in food products in the United States, leaving consumers vulnerable to potential risks.

With the EPA's proposed expansion of chlormequat usage on domestically grown crops, the study's findings serve as a crucial call to action for greater transparency in pesticide usage and monitoring, as well as consumer awareness so we can work toward a food supply that safeguards the well-being of the individual.



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