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Review Article

Microplastic in the farm animal derived food chain: The silent contaminants from farm to fork

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Abstract

This review highlights research from the past five years on microplastic (MP) contamination in foods of animal origin and the associated health risks. MPs, ranging from 0.1 µm to 5,000 µm, are widespread in the environment and pose significant ecological hazards. They can enter animals through ingestion, respiratory pathways, and surface contact. Products such as milk, meat, eggs, and their derivatives have been found contaminated with MPs, either at the farm level or during processing and packaging. Consumption of these contaminated products poses serious health risks, as toxic polymers in MPs which can disrupt cell membranes and damage critical organelles, including mitochondria, lysosomes, the endoplasmic reticulum, and the nucleus, leading to disorders affecting the digestive, respiratory, reproductive, and nervous systems. Preventing MP contamination in animal-derived foods requires a comprehensive strategy encompassing improved farm management, reduction of MPs at their sources, policy measures, technological solutions, and active community participation. Food safety regulations should also consider MPs as a parameter for ensuring the quality and safety of animal-derived products.

Keywords: Eggs, Human health, Meat, Microplastic, Milk

Highlights

- Microplastics (0.1–5,000 µm) contaminate animal-derived foods at farm level or during processing
- MP can cause disorders affecting the digestive, respiratory, reproductive, and nervous systems
- Prevention needs integrated farm, policy, tech, and community strategies

INTRODUCTION

Plastics are among the most widely used materials in everyday life because of their durability, low cost, ease of manufacturing, and resistance to corrosion. Their usage is steadily rising, with global production reaching about 350 million tonnes annually. Since 1950, the cumulative plastic production has been estimated at 8,300 million metric tonnes (Kiruba et al., 2022), with Asia alone accounting for nearly half of the total output (Kiruba et al., 2022). Approximately 71% of discarded plastics are directly released into the environment (Badwanache & Dodamani, 2024), where they undergo fragmentation into smaller particles through mechanical, physicochemical, and biological processes (Andrady, 2017; Ashrafy et al., 2023). Plastic particles ranging from 0.1 µm to 5,000 µm in size are classified as MP (European Food Safety Authority [EFSA], 2016). MP are predominantly composed of polyethylene (PE), polyethylene terephthalate (PET), polypropylene (PP), nylon, and polymethyl methacrylate (PMMA). Of these polymers, PE, PET, and nylon exhibit degradability, whereas PP and PMMA are considered non-degradable (Kiruba et al., 2022). Primary MP are intentionally manufactured for use in products like scrubs, toothpaste, body washes, and cosmetics due to their abrasive properties (Rahim et al., 2022). In contrast, secondary MP arise from the degradation of larger plastic waste (Pivokonsky et al., 2018). These particles are widely dispersed in the environment and pose serious ecological risks (Lamichhane et al., 2023), contributing to issues such as ocean acidification, climate change, and ozone depletion (O'Brien et al., 2023; Yang et al., 2021). MP are now recognized as one of the four major global environmental threats to human health (O'Brien et al., 2023). They can enter living organisms through ingestion, inhalation, or dermal contact (Zhang et al., 2020) and tend to accumulate in organs such as the gastrointestinal tract, liver, testes, and ovaries. This accumulation may trigger carcinogenic effects, inflammatory reactions, oxidative stress, and genetic damage (Singh et al.,

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2021). MP enter the animal-derived food chain through live animals and their products, eventually reaching the human body upon consumption. They have been detected in a wide range of food sources, including drinking water (Zhang et al., 2020), fish and seafood (Diaz-Basantes et al., 2022), milk and dairy products (Visentin et al., 2025), eggs (Liu et al., 2022), and beverages (Shruti et al., 2020). However, the regulations laid by the agencies responsible for maintaining quality and safety of foods, such as Food and Agriculture Organization (FAO), World Health Organization (WHO), Food and Drug Administration (FDA), International Organization for Standardization (ISO) and Hazard Analysis Critical Control Points (HACCP) do not include the presence of MP in food items. But, the exposure to MP poses significant risks to human health, being linked to conditions such as obesity, diabetes, cancer, reproductive disorders, and cardiovascular diseases (Prata et al., 2020). In addition, contamination of foods of animal origin may result in reduced quality and diminished product value (Sutanto et al., 2024). This review summarizes research from the past five years on MP contamination in animal-derived foods and the related health risks. The primary objective is to highlight the presence of MP in the food chain and their potential impacts on human health.

Animal exposure to MP

MP are extensively distributed across aquatic, terrestrial, and atmospheric ecosystems. However, most research has focused on their accumulation in marine environments compared to freshwater or terrestrial systems (Eriksen et al., 2014: Blettler et al., 2018). Marine MP primarily originates from land-based human activities and are transported via freshwater sources, with an estimated 80% of marine MP being land-derived (Duis & Coors, 2016). Aquatic animals are exposed to these particles through two main routes: primary consumers such as zooplankton, invertebrates, and echinoderms mistakenly ingest them as food (Brennecke et al., 2015), while secondary consumers including fish, seabirds, and marine mammalstake them up indirectly by feeding on contaminated primary consumers (Xu et al., 2022). Apart from ingestion, the MP can also be accumulated in the gill of aquatic animals during respiration (Lestari et al., 2023).

Terrestrial animals are exposed to MP primarily through soil, which acts as a major reservoir due to the breakdown of plastic waste from human activities (Rillig, 2012). MP present in surface soils can migrate into deeper layers via leaching and agricultural practices (Li et al., 2018). Plants take up MP as aggregates through root hairs by transpiration (Mateos-Cárdenas et al., 2019), which are then transported to edible tissues via the xylem (Li et al., 2023). Additionally, plant exposure can occur through absorption via leaf stomata (Adeel et al., 2018). The farm animals are exposed to microplastics from a variety of sources such as feed, drinking water, air and plastic equipments (Zhang et al., 2025). Studies conducted in a goat farm in Indonesia, reported 200 particles per kilogram MP in feed and 150 particles per kilogram MP in drinking water with PE and LDPE polymers (Wahyudi et al., 2025). Herbivorous animals ingest MP when feeding on such contaminated plants. MP have been detected in cattle (Beriot et al., 2021; Meyer et al., 2023), goats (Habib et al., 2022), sheep (Beriot et al., 2021), pigs (Li et al., 2023), camel (Eriksen et al., 2021) and deer (Harne et al., 2019). A German study reported the presence of MP in 30% of cattle and 6% of sheep digestive tracts (Meyer et al., 2023). Similarly, research in Spain found 2116±1024 particles/kg of soil in grazing land, while sheep from the same fields excreted 997±971 particles/kg of MP in their feces (Beriot et al., 2021). The ruminants can also consume MP directly from soil during grazing. Studies have shown fresh feed like fresh roughages have no plastic particles (van der Veen et al., 2022). In pig feed, polyethylene is reported as the predominant plastic polymer, with concentrations of about 139±115 MP particles per kilogram of feed (Wu et al., 2021) followed by polyethylene terephthalate (PET), polycarbonate (PC), and phthalate plasticizers (Sheriff et al., 2023; Olmo et al., 2025).

However, the majority of research on direct ingestion of plastic by the ruminants originates from developing nations, largely because of inadequate waste management systems and the tendency of livestock to graze directly on garbage (Corte Pause et al., 2024). Several cases of plastic impactions have been reported in cattle and buffaloes from India (Mahadappa et al., 2020). Soil-dwelling organisms like earthworms and jump worms absorb MP from the soil (Rillig et al., 2017), which then transfer into terrestrial animals via the food chain (Zeng et al., 2015). Poultry and small birds that consume earthworms become contaminated and larger birds feed on smaller birds or small mammals also accumulate MP. Carnivores such as lions, tigers and wolves prey on the herbivores contaminated with MP.

Small sized MP are suspended in air and may enter through respiratory passage during inhalation. But, majorities of them are entrapped within the respiratory passage. Studies conducted on pigs showed 6 and 12

Table 1. Availability of MP in different tissues of domestic animals

Animals	Tissues	Amount	References
Cattle	Milk	2040–10,040 MP/L	Da Costa Filho et al. (2021)
	Manure	4520 MP/kg	Zhang et al. (2022)
Sheep	Faeces	997 MP/kg	Beriot et al. (2021)
Goat	Meat(cut)	2200–6500 MP/kg	Habib et al. (2022)
Chicken	Meat(cut)	30–1190 MP/kg	Habib et al. (2022)
	Eggs	11.67 MP/egg	Liu et al. (2022)
Duck	Intestine	11–49 MP/intestine	Susanti et al. (2021)
Pig	Lungs	6 MP/gram in adult pigs	Li et al. (2023)
		12 MP/gram in fetal pigs	van der Veen et al. (2022)
	Manure	3547 MP/kg	Zhang et al. (2022)

MP particles/gram of lung tissue in adult and fetal pigs respectively (van der Veen et al., 2022; Li et al., 2023). Additionally, pigs may be exposed to MP through drinking contaminated water and inhaling polluted air (van der Veen et al., 2022).

MP are generally eliminated from the body through bile and passed out in faeces (Wu et al., 2021). In rumen, microplastics are degraded into finer particles that can be absorbed, stored in tissues, and eventually contaminate products of animal origin (Da Costa Filho et al., 2021; Liu et al., 2022). Some microplastics (PE, PP, PVC, and PS) have the ability to absorb heavy metals such as cadmium which could be released into the rumen after degradation (Liao & Yang, 2022). Table 1 outlines their detection in various animal organs and products.

MP in milk and dairy products

Milk serves as a potential dietary route for MP to enter the human body. Contamination has been detected in both raw and powdered milk (Da Costa Filho et al., 2021), as well as in dairy products like cheese and yogurt (Adjama et al., 2024). The major contaminants include industrial polymers such as polyethyl acrylate (PEA), hydrogenated nitrile butadiene rubber (HNBR), and polytetrafluoroethylene (PTFE) (Gürmeriç & Basaran, 2025). Sources of contamination may arise either at the farm (Sobhani et al., 2020) or during processing (Diaz-Basantes et al., 2020). At the farm level, poor hygiene, contaminated drinking water, and feed contribute to MP exposure, while during processing, inadequate handling and packaging increase the risk. Animals are also exposed to MP via feed, polluted water, and direct environmental contact. The contamination of MP varies considerably between different dairy products (Table 2) and the cheese contains maximum MP contaminants (Visentin et al., 2024) which may be because cheese making requires long processing and prolonged contact with

Table 2. MP contamination levels and their characteristics in milk and dairy products

Samples	Amount of MP	Chemical nature	References
Raw milk (Cow)	84–128 MPs/kg	PEA, EPC, HNBR, PAM, PARA, CR, PTFE	Rbaibi Zipak et al. (2024)
Raw milk (Cow)	7–23 MPs/kg	PMMA, PA	Banica et al. (2024)
Raw milk (Goat)	100 MPs/kg	PE, LDPE	Wahyudi et al. (2025)
Conventional milk	2–36 MPs/kg	PMMA, PA, PE, PU, polyester	Banica et al. (2024)
Organic milk	10–99 MPs/kg	PMMA, PA, PU, polyester	Banica et al. (2024)
Raw milk	Not available	PS, PP, PVC	Badwanache & Dodamani (2024)
Branded milk	95–250 MPs/kg	PE, PP, Nylon-6, PS, PA	Chakraborty et al. (2024)
Raw milk	2040–6250 MPs/kg	PE, PES, PP, PU, PA, PTFE	Da Costa Filho et al. (2021)
Yoghurt	0–1660 MPs/kg	PA, PET, PVC, PE, PC, PMMA, PU	Abedi et al. (2025)
Buttermilk	0–2000 MPs/kg	PA, PET, PVC, PC, PMMA, PU	Abedi et al. (2025)
Skim-milk powder	466–5765 MPs/kg	PEVA, PE, CPE, PP, PVC, PA, PC, polyisoprene, polyvinylidene fluoride	Visentin et al. (2024)

Cont. Table 2.

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Samples	Amount of MP	Chemical nature	References
Butter	375–1500 MPs/kg	PA, acrylic	Banica et al. (2024)
Infant milk powder	0–180 MPs/kg	PE, PET, PP, PA, PVC	Zhang et al. (2023)
Skim milk	134–444 MPs/kg	HDPE, LDPE, PAM, PP	Diaz-Basantes et al. (2020)
Cheese	1.852±283.3 MPs/kg	Not available	Visentin et al. (2024)

(PEA: Polyethyl acrylate, EPC: Ethylene propylene copolymer, HNBR: Hydrogenated nitrile butadiene rubber, PAM: Polyacrylamide, PARA: Polyaramid, CR: Polychloroprene, PTFE: Polytetrafluoroethylene, PA: Polyamide, PMMA: Polymethyl methacrylate, PE: Polyethylene, PU: Polyurethane, PS: Polystyrene, PP: Polypropylene, PVC: Polyvinyl chloride, PES: Polyether sulfone, PET: Polyethylene terephthalate, PEVA: poly(ethylene-vinyl acetate), CPE: Polyethylene chlorinated, HDPE: High-density polyethylene, LDPE: Low-density polyethylene)

instruments, processing surface. One study reported contamination levels of 14 MP/L during processing attributed to membrane filters (Kutralam-Muniasamy et al., 2020). Majorities of MP detected in milk were all are less than 500 µm and appeared as fibers, fragments, and pellets with pink, blue, and purple color (Kiruba et al., 2022).

MP in eggs

Compared to milk, research on MP contamination in eggs is limited and often contradictory (Liu et al., 2022; Shelver et al., 2024; Tariq et al., 2024). Tariq et al. (2024) reported that the concentrations of PS and PVC MP in chicken eggs were below the detection limits (0.04 µg/g for PS and 0.22 µg/g for PVC). In contrast, Liu et al. (2022) found that chicken eggs contained 11.67±3.98 particles/egg of MP sized 50-100 µm, with polyethylene being the dominant type. Experiments with laying hens fed polystyrene showed poor absorption (<1% of the administered dose) and only minimal transfer to eggs (<0.3%) (Shelver et al., 2024). Similarly, Curl et al. (2023) identified MP in loggerhead sea turtle eggs from northwest Florida, averaging 1.46±0.01 particles per egg, with polyethylene (11%) and polystyrene (7%) being the most common forms. In chicken eggs, MP were found at higher levels in the yolk (8.95±4.58 particles/egg) compared to the egg white (3.40±1.52 particles/egg), likely due to their lipophilic properties (Prata et al., 2021). Notably, cooking did not alter MP distribution in eggs (Liu et al., 2022).

MP contamination in chicken

The primary route of MP intake in poultry is through plastic litter materials (Wu et al., 2021), followed by contaminated feed and drinking water (Li et al., 2023). Once ingested, these particles often lodge in the gizzard or proventriculus, where they undergo mechanical fragmentation (Yin et al., 2023), leading to the release of MP-associated chemicals. These substances can then accumulate in various tissues, including the gastrointestinal tract, liver, and muscles (Jha & Mishra, 2021; Horvatits et al., 2022). An overview of MP contamination in different avian tissues is provided in Table 3.

MP contamination in mutton, pork and beef

MP contamination has been detected in both beef and mutton (Bahrani et al., 2024). Tissue analysis revealed concentrations of 0.14±0.05 particles/g in cattle and 0.13±0.02 particles/g in sheep, with the highest levels occurring in cow muscle and the lowest in sheep liver (Bahrani et al., 2024). Similarly, Habib et al. (2022) identified 2.2±0.6 particles/g of MP in chevon. The main polymers present in beef tissues were nylon and LDPE, while sheep tissues predominantly contained nylon, PS, and LDPE (Bahrani et al., 2024). Further, Visentin et al. (2024) reported between 200.0 and 38,400.0 MP particles per kg in beef hamburgers, with polycarbonate, polyethylene, and polypropylene as the major polymers. A large proportion of these contaminants originate from processing and packaging materials, such as plastic cutting boards (Habib et al., 2022) and food trays (Kedzierski et al., 2020). Meat packaged in extruded polystyrene (XPS) trays was found to contain 4.0–18.7 particles/kg of MP, which are particularly difficult to eliminate (Kedzierski et al., 2020). Likewise, goat meat samples processed on plastic cutting boards showed contamination ranging from 1.2±0.6 to 7.2±4.5 particles/g. Studies have also reported the presence of MP contamination in pork samples from both the United States and the Netherlands, including organic pork (van der Veen et al., 2022). In pig manure, MP concentrations of $9.02 \times 10\{^{2} \pm 1.29 \times 10\}^{3}$ particles/kg have been documented (Sheriff et al., 2023). Furthermore, evidence suggests that the pig colon harbors genes (HADH, amiE, ure A, ure B, ure C, fadN) and microorganisms involved in MP degradation, with Firmicutes and Bacteroidetes identified as the dominant bacterial phyla contributing to this process (Wang et al., 2024).

Table 3. MP contamination in different tissues of poultry birds

Tissue	Amount of MP	Chemical nature	References
Crops and gizzards of poultry	33.25±7.8 MPs/gizzard 17.8±12.1 MPs/crop	PVC, LDPE, PS, Polypropylene homopolymer (PPH)	Bilal et al. (2023)
Crops and gizzards of poultry	57±41.1 MPs/gizzard, 32.4±15.1 MPs/crop	PE, PS	Lwanga et al. (2017)
Crops and gizzards of poultry	45.82±42.6 MPs/gizzard 11±15.3 MPs/crop	Not available	Huerta et al. (2017)
GI tract of birds of prey	11.9 2.8 MPs/GIT	PET, ethylene-co-polypropylene and cellulose	Carlin et al. (2020)
Kidney of poultry	Not available	PS	Meng et al. (2022)
Heart of poultry	Not available	PS	Zhang et al. (2022)
TesticularTissue and blood of chicken	Not available	PS	Hou et al. (2022)
Muscles of chicken	561.593 mg/kg breast muscles d 884.712 mg/kg leg muscles	PS, PET and polyamide	Chen et al. (2023)
Lung tissue of adult pigs	6 MP/gram in adult pigs, 12 MP/gram in fetal pigs	Polyamide, PP, PE, PVC, Polycarbonate and PET	van der Veen et al. (2022) Li et al. (2023)
Blood in pigs	Not available	PVC, PP, PS, PE, PET	van der Veen et al. (2022)

MP exposure has been linked to kidney injury (Meng et al., 2022), cardiac tissue damage (Zhang et al., 2022. It also impairs reproductive performance in poultry (Hou et al., 2022). The MP are also reported to trigger immune responses such as inflammation and production of cytokines (Jiang et al., 2020). The endocrine disruption is also reported upon MP exposure (Ullah et al., 2023), which may affect the egg production.

Table 4. Amount of MP consumed by humans through animal-derived food chain

Source	Amount of MP ingested by human	Country	References
Milk	0.21 particles/mL/day (Age group up to 15 years)5289 particles/mL/70-years	Turkiye	Basaran et al. (2023)
	30.6 to 79.5 particles/person/day	India	Kiruba et al. (2022)
Fish	174.43 particles/kg BW/year (Children) 127.19 particles/kg BW/year (Adult)	Iran	Makhdoumi et al., (2021)
Egg	11.67±3.98 particles per day	China	Liu et al. (2022)
	5.84 particles per day	Japan	
	5.00 particles per day	India	
	5.06 particles per day	United States	
Beef	0.45 - 0.64 particles/kg BW/day (Adult) 0.34 - 0.48particles/kg BW/day (Children)	Iran	Abd El-Hack et al. (2025)
Mutton	0.21 - 0.45 particles/kg BW/day (Adult) 0.16 - 0.34 particles/kg BW/day (Children)	Iran	Abd El-Hack et al. (2025)

Human exposure to MP through the animal-derived food chain

The primary pathway for human MP intake is through food and drinking water (Schwabl et al., 2019). In India, the estimated daily ingestion per individual ranges from 122.25±177.38 to 202.80±294.25 mg (Yadav et al., 2022). A study conducted in the United States reported an annual dietary intake of 39,000 to 52,000 MP particles, with variations influenced by age and sex (Cox et al., 2019). When drinking water is included, the estimated exposure increases by nearly 22-fold. Overall, the amount of MP consumed by humans differs substantially depending on the source (Table 4)

After ingestion, larger MP are usually trapped in mucus and eliminated through feces (Schwabl et al., 2019). In contrast, smaller MP (<20 μm) that bypasses the mucosal barrier can be absorbed in Peyer's patches

(Thompson et al., 2024). Within the digestive tract, these particles are taken up by enterocytes via transcytosis (Prata, 2023). Some MP are also internalized by M cells and macrophages (Thompson et al., 2024). Additionally, their entry may occur through paracellular pathways across gap junctions (Prata, 2023). Once absorbed, MP can travel to various organs as they are capable of breaching physiological barriers, including the blood–testis and placental barriers (Fournier et al., 2020). Crossing the feto-placental barrier allows them to accumulate in fetal liver, lungs, heart, and kidneys (Fournier et al., 2020). MP originating from the food chain may even reach the fetal brain after placental transfer, posing risks of neurodevelopmental disorders (Da Costa Araújo, 2021; Jeong et al., 2022).

According to Zeng et al. (2025), the average MP intake in humans is about 5 g per week. Their excretion through feces ranges from 0.01 to 14.6 mg/g, while concentrations detected in circulation are approximately 1.6 μg/mL. In the human placenta, reported MP levels vary between 6.5 and 790 μg/g of tissue.

Effects of MP in human

The primary pathway of human exposure to MP from animal-derived foods is ingestion, although minor exposure may also occur through direct contact with these products (Pironti et al., 2021). The build-up of MP in tissues poses significant health risks, with their toxicity largely influenced by particle size and polymer type. Research indicates that particles ranging from 0.1 - 5 μm cause relatively little harm to intestinal cells (Wu et al., 2019), whereas smaller particles in the range of 50 nm - 0.5 μm produce pronounced toxic effects in the gastrointestinal tract (Hesler et al., 2019). MP can damage cell membranes and key organelles, including mitochondria, lysosomes, the endoplasmic reticulum (ER), and the nucleus. Nanoplastics in particular are known to increase lipid oxidation, alter membrane fluidity, and impair mitochondrial function by disrupting membrane potential, enhancing reactive oxygen species production, and activating pro-apoptotic genes (Fröhlich, 2013; Wu et al., 2019; Wang et al., 2021). In the ER, MP have been shown to disturb normal function by triggering inositol-1,4,5-triphosphate-mediated–mediated calcium release, leading to apoptosis (Wu et al., 2021). Lysosomal activity is also affected, with increased proton-pump activity and chloride ion influx causing acidification and eventual rupture (Fröhlich, 2013). Furthermore, MP can penetrate the nuclear membrane, disrupt mitotic spindle formation, and induce genotoxicity (Cacciamali et al., 2022). A summary of the reported effects of MP on humans is presented in Table 5.

Table 5. Effects of MP in human

System	Effects	References
Digestive system	Damage of the intestinal cells and disrupts the tight intestinal junction by altering energy metabolism	Stock et al. (2019); Litvak et al. (2018).
	Intestinal damage, alterations of intestinal flora, and disruption of intestinal barrier in mice	Qiao et al. (2021)
	Altered community structure and composition of gut microbiota.	Djouina et al. (2022)
	Intestinal dysbiosis: decrease in beneficial bacteria and increase in harmful bacteria.	Djouina et al. (2022)
	Polystyrene MP can cause oxidative damage, membrane alteration and apoptosis of hepatocytes	Li et al. (2021).
Respiratory system	Loss of respiratory epithelial integrity by disruption of tight junction through the phosphorylation of tight junction proteins like zonulaoccludens (ZO)	Sethi et al. (2019).
	Inflammation of respiratory epithelim to cause asthma and chronic obstructivepulmonary disease (COPD)	Prata, (2018).
	Polystyrene can cause cellular toxicity and secretion of pro inflammatory cytokines.	Xu et al. (2019).
Reproductive system	Deposition of MP in testicular tissue can lead to testicular inflammation, disruption of blood–testis barrier and impaired spermatogenesis	Hou et al. (2021); Jin et al. (2021).
	Accumulation of MP at chorionic membrane impairs	Duan et al. (2020).

Cont. Table 5.

Table 5., Cont. ...

System	Effects	References
	the gas exchange mechanism to reduce the rate of oxygen utilization of the embryo.	
	Utero-placental transport of MP leads to their accumulation in fetal liver, lungs, heart, kidneys, and brain to effect fetal development.	Lehner et al. (2019); Fournier et al. (2020).
Nervous system	MP can cross the fetal blood-brain barrier and cause neuropathy	Jeong et al. (2022).
	MP inhibit the expression of genes related to neurodevelopment and enzymes for neurotransmitter synthesis	Da Costa Araújo (2021)
	Inhibit neuronal formation during the early development stage	Fournier et al. (2020).
	Damaged brain function and cognitive deficits	Jeong et al. (2022).

Strategies to control MP contamination

Prevention of MP contamination in animal production and products requires a holistic approach involving proper farm management, MP reduction from the sources, policy initiatives, technology interventions, and community involvement (Amesho et al., 2023; Akanda et al., 2025). A sustainable alternative to plastic is essential to reduce MP contamination in the environment (Ferreira-Filipe et al., 2021). Primarily, MP contamination can be reduced by using alternate biodegradable materials instead of MP (Chapman, 2018; Goh et al., 2024), which may reduce the MP contamination through the packaging of animal feed and animal products. Application of a circular economy using biodegradable materials for crop production and integrated crop-livestock systems reduce plastic use for fertilizer bags and animal feed packets (Hassan, 2024). Moreover, farmers need to adopt proper management practices by removing all plastic packaging from animal feed to reduce MP contamination (Olmo & Holman, 2025). Utilization of different water treatment and filtration technologies can remove MP from the drinking water of livestock; on the other hand, wetlands, biofilters (Hettiarachchi & Meegoda, 2023), suitable microbes, and plants can remove and degrade plastic from soil and water. A strict regulatory policy on plastic use and continuous monitoring of MP in soil, feed, and the environment is essential to keep our precious food animals and animal products contamination-free. Finally, a collective initiative from the environmental, human, and animal health sectors can prevent MP contamination and ensure food security (Akanda et al., 2025).

Conclusion

MP contamination in foods of animal origin is emerging as a serious food safety and public health concern. Evidence from recent studies clearly indicates that animal-derived products such as milk, meat, and eggs can act as potential vectors of MPs to humans, either through direct contamination at the farm level or via processing and packaging. Given their ability to disrupt cellular integrity and impair multiple organ systems, MP must be recognized as an important foodborne hazard. Addressing this issue demands a multi-pronged approach involving source reduction, better farm and processing practices, robust policy interventions, advanced monitoring technologies, and public engagement. Incorporating MP into food safety standards will be crucial for protecting consumer health and ensuring the sustainability of food systems.

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