Comunicazione Orale

MICROPLASTICS IN COMMERCIAL INFANT FORMULA: A PRELIMINARY CONTAMINATION ASSESSMENT

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Microplastics (MPs), synthetic particles between 0.1 and 5,000 µm in size, are recognized as ubiquitous food chain contaminants. Infants are particularly vulnerable due to immaturity of the gut ecosystem and detoxification capacity, and higher food intake per unit of body weight (bw) compared to adults. Despite this, little attention has been paid to contamination of infant formulas, although such products may represent the only nutritional source during the most critical developmental window when breastfeeding is not possible. This preliminary study assessed MP contamination in terms of particle type, morphology, size, and count in commercial infant formulas from the Italian market.

Six products designed for feeding healthy babies were selected, covering three age categories: 0–6 months, 6–12 months, and 0–12 months, from four manufacturers (A1 and B1:0-6 m, A2 and B2:6-12 m, C and D:0-12 m). For each type of formula, three samples with different batch numbers were purchased and analyzed (n.18 liquid formula samples), in order to capture potential batch–to–batch variability in production. MPs were isolated using a digestion step with hydrogen peroxide and vacuum filtration, then identified by stereomicroscopy and µ-FTIR spectroscopy. Particles were classified as microfibers (MFs) or fragments. Natural/artificial MFs were also counted and classified. Blank correction was applied by subtracting the mean blank value across replicates.

MPs were detected in all six products. After blank correction, mean MF levels ranged from 1.50±1.00 (A1) to 7.67±6.93 (A2) per 100 mL; the average of fragments was from 1.00±1.00 (B1) to 3.33±1.15 (A1). Sample C showed the highest concentration of synthetic MFs (52.2% of total fibers), suggesting a product-specific contamination source. The Estimated Daily Intake for infants aged 6 months ranged from 2.71 to 8.00 MPs/kg bw/day. The most frequently identified polymers were cellulose/rayon (50%), polyester (21%), and polyethylene (10%). Particles displayed a range of colors such as black (34%), blue (29%), orange (10%), and blue sky (9%). Mean MF lengths ranged from 624.13 µm (B2) to 1,353.65 µm (C); the average of the fragment size was from 82.28 µm (A2) to 125.82 µm (D), except the B2 sample (mean fragment size 797.73 µm). The observed dimension range (MFs:81.37-4,451.83 µm, fragments:27-4,505.57) places particles within size classes of recognized biological concern since sub-100 µm particles (60% of the fragments) carry potential threat for intestinal absorption in the immature neonatal gut, while larger particles may be associated with microbiome disruption. No consistent contamination trend by age category was identified, indicating manufacturing process and packaging as primary contamination sources. Exploratory statistics confirmed no significant differences among products (Kruskal-Wallis: $H=1.857$, $p=0.869$; Mann-Whitney: all ns).

These preliminary findings raise concerns about early life exposure to MPs and their potential effects on infant health. The conditions and processes involved in the production of infant formulas can introduce MPs. However, to date, the presence of MPs in food has not been regulated because MPs are a relatively new potential threat, and their complex nature makes risk analysis difficult. Further research in this area, identifying MP sources and mitigation measures, as well as stricter quality controls in manufacturing and the development of safer biodegradable packaging materials, is of utmost importance.