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LETTER TO THE EDITOR, NEWS AND VIEWS

Neurodevelopmental disorders and pesticide exposure: the northeastern Italian experience

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Abstract Endocrine disruptors are chemical substances that can interfere with the endocrine system. They include pesticides, metals, additives or contaminants in food, and personal care products. Pesticides are the only substances intentionally released into our environment to kill living things (herbicides, insecticides, fungicides, rodenticides). There is scientific evidence that exposure to pesticides produces a growing number of human pathological conditions; among these, stillbirth is an emerging issue.

Keywords Pesticides · Endocrine disruptors (EDs) · Environment · Neurodevelopment · Stillbirth · Gas chromatography–mass spectrometry (GC–MS)

Endocrine disruptors are chemical substances that can interfere with the endocrine system. They include pesticides, metals, additives or contaminants in food, and personal care products (Pusiol et al. 2016). Pesticides are the only substances intentionally released into our environment to kill living things; for example, they are used to kill weeds (herbicides), insects (insecticides), fungus (fungicides) or rodents (rodenticides). There is scientific evidence that exposure to pesticides produces a growing number of human diseases (Mostafalou and Abdollahi 2016). In their very accurate review, Mostafalou and Abdollahi have identified 43 human diseases divided into six broad groups of toxicities, caused by pesticide exposure. In the neurotoxicity, the authors include Alzheimer disease, Parkinson disease, amyotrophic lateral sclerosis (Mostafalou and Abdollahi 2016). Here, we would like to call attention to the pesticide neurotoxicity in fetuses and newborns. Our research group has in fact investigated by gas chromatography–mass spectrometry (GC–MS) the presence of endocrine disruptors (EDs) in 51 cortex specimens, coming from 43 cases of sudden intrauterine unexplained death syndrome (SIUDS) and 8 cases of sudden infant death syndrome (SIDS), occurred in the Northeast Italy, a region notoriously devoted to intensive farming, in the last five years (Roncati et al. 2016). More in detail, 25 EDs have been subjected to GC–MS, following the standard protocols: among the analyzed substances, five organochlorine pesticides, that is α-chlordane, γ-chlordane, heptachlor, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), and the two most common organophosphorus pesticides, chlorpyrifos and chlorfenvinphos, have been detected at part-per-billion (ppb) levels in 15 SIUDS and 3 SIDS, respectively. Therefore, the environmental EDs have been found to be able to cross the placental barrier, until to reach the fetal and neonatal brains (Roncati et al. 2015). Here, they can give origin to developmental alterations, especially of the basal nuclei, the major controllers of the vital functions, and to impairment of the receptorial expression, such as orexin (Lavezzi et al. 2016). These findings imply a conceptual redefinition of the fetal-placental and fetal blood–brain barriers and open the way for a possible ED involvement in stillbirth, too. Moreover, our findings are in accordance with the environmental diffusion of contaminants in intensive

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agricultural areas represented by the Northeast Italy. The Italian National Institute for Environmental Protection and Research (ISPRA) has published a detailed report on the presence of pesticides in surface and ground water in the period 2013–2014 (ISPRA 2016). Thanks to this extensive analysis, 102 substances have been researched, and 33 of them have been detected in 18–23% samples of surface waters. Among these, boscalid, dimetomorf, fluopicolide and chlorpyrifos have been resulted the chemicals most frequently found; unsurprisingly, chlorpyrifos is one of the EDs detected also in our examined brain samples, coming from SIUDS and SIDS victims.

Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

References

ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) (2016) Rapporto nazionale pesticidi nelle acque dati 2013–2014. ISPRA—Settore Editoria, Rome, Italy. http://www.isprambiente.gov.it/files/pubblicazioni/rapporti/rapporto-244/Rapporto_244_2016.pdf

Lavezzi AM, Ferrero S, Roncati L, Matturri L, Pusiol T (2016) Impaired orexin receptor expression in the Kölliker–Fuse nucleus in sudden infant death syndrome: possible involvement of this nucleus in arousal pathophysiology. Neurol Res 29:1–11. doi:10.1080/01616412.2016.1201632

Mostafalou S, Abdollahi M (2016) Pesticides: an update of human exposure and toxicity. Arch Toxicol. doi:10.1007/s00204-016-1849-x

Pusiol T, Lavezzi AM, Matturri L, Termopoli V, Cappiello A, Piscioli F, Roncati L (2016) Impact assessment of endocrine disruptors on sudden intrauterine and infant death syndromes. Eur J Forensic Sci 3:8–15. doi:10.5455/ejfs.197968

Roncati L, Barbolini G, Pusiol T, Piscioli F, Maiorana A (2015) New advances on placental hydrops and related villous lymphatics. Lymphology 48:28–37

Roncati L, Pusiol T, Piscioli F, Barbolini G, Maiorana A, Lavezzi A (2016) The first 5-year-long survey on intrauterine unexplained sudden deaths from the Northeast Italy. Fetal Pediatr Pathol 16:1–12. doi:10.1080/15513815.2016.1185751