Pesticide residues in food — 2019

Joint FAO/WHO Meeting on Pesticide Residues

EVALUATIONS 2019

Part II – Toxicological



Food and Agriculture Organization of the United Nations



Pesticide residues in food – 2019

Toxicological evaluations

Sponsored jointly by FAO and WHO

Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Core Assessment Group on Pesticide Residues

Geneva, Switzerland, 17–26 September 2019

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Food and Agriculture Organization of the United Nations



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^{*} First full evaluation

^{**} Evaluated within the periodic review programme of the Codex Committee on Pesticide Residues

2018 Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Core Assessment Group on Pesticide Residues

Geneva, 17–26 September 2019

List of WHO participants

WHO Experts

- Mr Davide Arcella, Evidence Management Unit (DATA), European Food Safety Authority (EFSA), I-43126 Parma, Italy
- Ms Janis Baines, Stirling ACT 2611, Australia
- **Professor Alan R. Boobis (Emeritus)**, National Heart and Lung Institute, Imperial College London Du Cane Road, London W12 0NN, United Kingdom
- **Dr Susy Brescia**, Chemicals Regulation Division (CRD), Health and Safety Executive (HSE) Bootle, Liverpool, United Kingdom
- **Dr Jessica Broeders**, Board for the Authorisation of Plant Protection Products and Biocides(Ctgb), Bennekomseweg 41, NL 6717 LL Ede, The Netherlands Ms Marloes Busschers, Hertogenbosch, The Netherlands
- **Dr Carl E. Cerniglia**, National Center for Toxicological Research, Food and Drug Administration, Jefferson, AR 72079, United States of America
- Dr Rhian Cope, Australian Pesticides and Veterinary Medicines Authority, Kingston ACT 2604, Australia
- Dr Ian Dewhurst, Leavening, North Yorkshire Y017 9SA, United Kingdom
- **Dr Mike Dinovi**, US Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Food Additive Safety, College Park, MD 20740, United States of America
- **Dr Salmaan Inayat Hussain**, Product Stewardship and Toxicology Section, Group Health, Safety, Security and Environment, Petroliam Nasional Berhad, Kuala Lumpur, Malaysia
- Dr Debabrata Kanungo, Food Safety and Standard Authority of India, Faridabad 121005, India
- **Dr Jean-Charles Leblanc**, Laboratory for Food Safety, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, 94701 Maisons-Alfort, France
- Ms Kimberley Low, Health Evaluation Directorate, Pest Management Regulatory Agency, Ottawa, Ontario K1A 0K9, Canada
- **Dr Elizabeth Mendez**, US EPA, Health Effects Div./Office of Pesticide Programs, Washington DC 20460, United States of America
- **Dr Francesca Metruccio**, International Centre for Pesticides and Health Risk Prevention, ASST Fatebenefratelli Sacco Polo Universitario Padiglione 17, 20157 Milano, Italy
- **Professor Angelo Moretto**, Department of Biomedical and Clinical Sciences University of Milan Luigi Sacco Hospital, 20157 Milano, Italy
- **Dr Pasquale Mosesso**, Associate Professor of Genetics, Department of Ecological and Biological Sciences, Università degli Studi della Tuscia Largo dell'Università s.n.c., I-01100 Viterbo, Italy
- **Dr Lars Niemann**, Toxicology of Pesticides and their Metabolites, Dept. Safety of Pesticides, German Federal Institute for Risk Assessment, D-10589 Berlin, Germany
- Dr Prakashchandra V. Shah, Brookeville MD 20833, United States of America
- **Dr Luca Tosti**, Department of Biomedical and Clinical Sciences University of Milan, University Hospital Luigi Sacco, 20157 Milano, Italy

- **Dr Gerrit Wolterink**, Centre for Nutrition, Prevention and Health Services (VPZ), National Institute for Public Health and the Environment, 3720 BA Bilthoven, The Netherlands
- Dr Midori Yoshida, Food Safety Commission of Japan, Tokyo 107-6122, Japan
- Dr Katsuhiko Yoshizawa, Mukogawa Women's University, Nishinomiya, Hyogo 663-8558, Japan

Dr Juerg Zarn, Federal Food Safety and Veterinary Office FSVO, CH-3003 Bern, Switzerland

Secretariat

- **Dr Manfred Luetzow**, Department of Food Safety and Zoonoses (FOS), World Health Organization, 1211 Geneva 27, Switzerland (WHO JMPR Secretariat)
- **Ms Nora Lune**, Department of Food Safety and Zoonoses (FOS), World Health Organization, 1211 Geneva 27, Switzerland (WHO JMPR Secretariat)
- Mr Soren Madsen, Department of Food Safety and Zoonoses (FOS), World Health Organization, 1211 Geneva 27, Switzerland (WHO JMPR Secretariat)

Dr Russell Parry, Shrewsbury SY2 6HZ United Kingdom (WHO Editor)

Ms Yong Zhen Yang, Plant Production and Protection Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy (FAO JMPR Secretariat)

Abbreviations and acronyms

AChE	acetylcholinesterase	FOB	functional observational battery
AD	administered dose	GC-MS	gas chromatography–mass
ADI	acceptable daily intake		spectrometry
ADME	a, distribution,	GD	gestation day
	metabolism and excretion	GEF	global evaluation factor
AFC	antibody-forming cell (assay)	GGTP	γ-glutamyl transpeptidase/transferase
A/GA:G	albumin:globulin ratio	GI	gastrointestinal
ALP	alkaline phosphatase	GIT	gastrointestinal tract
ALT	alanine transaminase	GLP	good laboratory practice
APTT	activated partial thromboplastin time	GSH	glutathione
AR	applied radioactivity	HBI	haemoglobin binding index
AR LBD	androgen receptor-ligand binding	Hb	haemoglobin
	domain	HCA	α-hexylcinnamaldehyde
ARfD	acute reference dose	HCD	historical control data
AR	androgen receptor	hERα/β	human estrogen receptor α/β
ARE	antioxidant response element	HPC	hydroxypropyl cellulose
AST	aspartate transaminase	HPLC	high-performance liquid
AUC	Area under the concentration-time		chromatography
	curve	Ht	haematocrit
BMD	benchmark dose	IC ₅₀	Half-maximal inhibitory concentration
BMDL _X	Lower confidence limit on the BMD for a $X^{0/2}$ response	ICH	International Conference on
BUN	blood urea nitrogen		Harmonisation of Technical Requirements for Pharmaceuticals
bw	body weight		for Human Use
ca	circa	i.p.	intraperitonial, intraperitonially
ca CCPR	circa Codex Committee on Pesticide	i.p. ISO	intraperitonial, intraperitonially International Organization for
ca CCPR	circa Codex Committee on Pesticide Residues	i.p. ISO	intraperitonial, intraperitonially International Organization for Standardization
ca CCPR ChE	circa Codex Committee on Pesticide Residues cholinesterase	i.p. ISO IUPAC	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and
ca CCPR ChE CHO	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary	i.p. ISO IUPAC	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry
ca CCPR ChE CHO <i>C</i> max	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration	i.p. ISO IUPAC i.v.	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously
ca CCPR ChE CHO C _{max} CMC	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose	i.p. ISO IUPAC i.v. JMPR	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on
ca CCPR ChE CHO C _{max} CMC CNS	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose central nervous system	i.p. ISO IUPAC i.v. JMPR	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on Pesticide Residues
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ca CCPR ChE CHO CMC CNS CP DAPI DHT DHT DMSO DNA DNCB ECG	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose central nervous system cyclophophamide 4',6-diamidino-2-phenylindole dihydrotestosterone dimethyl sulfoxide deoxyribonucleic acid 2,4-dinitrochlorobenzene electrocardiograph(ic)	i.p. ISO IUPAC i.v. JMPR K_{M} LC ₅₀ LC-MS LD ₅₀ LD LDH	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on Pesticide Residues Michaelis constant median lethal concentration Liquid chromatography–mass spectrometry median lethal dose lactation day lactate dehydrogenase
ca CCPR ChE CHO Cmax CMC CNS CP DAPI DHT DHT DMSO DNA DNCB ECG EC	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose central nervous system cyclophophamide 4',6-diamidino-2-phenylindole dihydrotestosterone dimethyl sulfoxide deoxyribonucleic acid 2,4-dinitrochlorobenzene electrocardiograph(ic) erythrocyte count	i.p. ISO IUPAC i.v. JMPR K_{M} LC ₅₀ LC-MS LD LD LDH LH	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on Pesticide Residues Michaelis constant median lethal concentration Liquid chromatography–mass spectrometry median lethal dose lactation day lactate dehydrogenase luteinizing hormone
ca CCPR ChE CHO C _{max} CMC CNS CP DAPI DHT DMSO DNA DNCB ECG EC EDTA	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose central nervous system cyclophophamide 4',6-diamidino-2-phenylindole dihydrotestosterone dimethyl sulfoxide deoxyribonucleic acid 2,4-dinitrochlorobenzene electrocardiograph(ic) erythrocyte count ethylene diamine tetracetic acid	i.p. ISO IUPAC i.v. JMPR $K_{\rm M}$ LC ₅₀ LC-MS LD ₅₀ LD LDH LH LH LOAEC	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on Pesticide Residues Michaelis constant median lethal concentration Liquid chromatography–mass spectrometry median lethal dose lactation day lactate dehydrogenase luteinizing hormone lowest-observed-adverse-effect concentration
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ca CCPR ChE CHO Cmax CMC CNS CP DAPI DHT DMSO DNA DNCB ECG EC EDTA ELISA E:P ratio EROD FAO	circa Codex Committee on Pesticide Residues cholinesterase Chinese Hamster ovary maximum concentration carboxymethyl cellulose central nervous system cyclophophamide 4',6-diamidino-2-phenylindole dihydrotestosterone dimethyl sulfoxide deoxyribonucleic acid 2,4-dinitrochlorobenzene electrocardiograph(ic) erythrocyte count ethylene diamine tetracetic acid enzyme-linked immunosorbent assay ratio of 17 β -estradiol to progesterone ethoxyresorufin- <i>O</i> -deethylase Food and Agriculture Organization	i.p. ISO IUPAC i.v. JMPR $K_{\rm M}$ LC ₅₀ LC-MS LD LDH LDH LH LOAEC LOAEL LSC MA	intraperitonial, intraperitonially International Organization for Standardization International Union of Pure and Applied Chemistry intravenous, intravenously Joint FAO/WHO Meeting on Pesticide Residues Michaelis constant median lethal concentration Liquid chromatography–mass spectrometry median lethal dose lactation day lactate dehydrogenase luteinizing hormone lowest-observed-adverse-effect concentration lowest-observed-adverse-effect level liquid scintillation counting motor activity
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MCHC	mean corpuscular haemoglobin concentration
MCV	mean corpuscular (cell) volume
MetHb	methaemoglobin
MPE	mean photo effect
MMAD	mass median aerodynamic diameter
MN(T)	micronucleus (test)
MOA	mode of action
MOAEC	maximum-observed-adverse-effect concentration
MRL	maximum residue limits
MS	mass spectroscopy/spectrometry
MTD	maximum tolerated dose
NBF	neutral buffered formalin
NCA	nicotinic acid
NCE	normochromic erythrocyte
NMR	nuclear magnetic resonance
NNG	net nuclear grain
NOAEC	no-observed-adverse-effect concentration
NOAEL	no-observed-adverse-effect level
NTE	neuropathy target esterase
OECD	Organisation for Economic Co-operation and Development
PAS	periodic acid-Schiff stain
PCE	polychromatic erythrocyte
PCN	pregnenolone-16α-carbonitrile
PCV	packed cell volume
PFC	plaque-forming cell (assay)
PIF	photo irritation factor
PND	postnatal day
PROD	pentoxyresorufin-O-deethylase
РТ	prothrombin time
PVDF	polyvinylidene difluoride
QA	quality assurance
QSAR	quantitative structure–activity

SI	stimulation index
sRBC	Sheep red blood cell
T.Bil	total bilirubin
$t_{\frac{1}{2}}$	half-life
T ₃	triiodothyronine
T_4	thyroxine
TDAR	T-lymphocyte-dependent antibody response
TFT	5-trifluorothymidine
TG	triglycerides
TK	toxicokinetic
TLC	thin-layer chromatography
$T_{\rm max}$	time to reach maximum concentration
TOCP	tri-o-cresyl phosphate
ТР	testosterone propionate
TPO	thyroid peroxidase
TRR	total radioactive residue
TSH	thyroid-stimulating hormone
TTC	threshold of toxological concern
UDP-GT	uridine diphosphate
	unscheduled DNA synthesis
V	maximum rate of reaction
w _{max}	white blood call/laugeoute count
WHO	World Health Organization
WHO	
V/ V	volume/volume
W/V	weight/volume
W/W	weight/weight

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