BfR MEAL Study
What's in your food

German Federal Institute for Risk Assessment

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BfR MEAL study: antibiotic concentrations in trout fillet, pork and turkey meat low

As part of the BfR MEAL study (Mahlzeiten für die Expositionsschätzung und Analytik von Lebensmitteln – meals for exposure assessment and analysis of foods), the first Total Diet study for Germany, trout fillet, pork and turkey meat samples were each analysed for around 20 different antibiotics and coccidiostats. At least one substance was determined in each of 19 of the 180 unprepared samples analysed. The levels of the substances were below the legally stipulated maximum residue levels: on average 18% and a maximum of 36% of the respective maximum levels. About 99% of the approximately 3,800 individual results generated for the substances analysed showed no detectable levels.

Veterinary drugs such as antibiotics and antibiotically active substances are used in livestock farming to treat animal diseases. Consequently, food from treated animals may contain residues of veterinary drugs. In order to ensure safe foods for consumers, legal maximum residue limits for veterinary drugs apply. Official food and feed control authorities check the compliance with the maximum residue limits in foods. This involves analysing whether the levels of corresponding substances in foodstuffs exceed the maximum residue limits.

The use of antibiotics in animal husbandry can also favour the development of resistance and the spread of bacteria with resistance. Antibiotic resistance means that pathogens are insensitive to certain antibiotics. It is therefore of particular interest to determine the actual levels of veterinary drug residues in food.

The content data for the analysed samples are available in a "*Public Use File*": https://www.bfr-meal-studie.de/de/public-use-file.html

The BfR MEAL study provides information on the average quantities of health-promoting and potentially harmful substances contained in the most commonly consumed foods in Germany. The acronym "MEAL" stands for "Meals for Exposure Assessment and Analysis of Food". Since 2016, food has been purchased for the MEAL study in the usual places of purchase and then prepared according to typical household recipes. Food is cooked, fried and baked in a study kitchen set up especially for the study - reflecting consumers behaviour

at home. Subsequent, the prepared food is analysed in the laboratory. The study focusses on more than 300 different substances.

The individual substances were grouped into work packages, known as modules, according to their content. In the "pharmacologically active substances" module, the levels of substances with an antibiotic effect were determined in individual samples of trout fillet, pork and turkey meat. Levels below the legally defined maximum residue limit were also taken into account.

One of the tasks of official food and feed control authorities is to check whether a sample complies with the legally stipulated maximum residue limits for the respective substance. Little is known about the actual exposure of consumers to veterinary drug residues below the maximum residue limits. In view of the possible development of resistance, this exposure is of particular interest for substances with an antibiotic effect. For the "pharmacologically active substances" module, the samples were therefore analysed for the levels of various antibiotics and coccidiostats (antibiotically active substances for the treatment of certain intestinal diseases caused by protozoa).

60 samples each of trout, pork and turkey were purchased. Each of the 180 samples in total was divided and some of them were prepared in a manner typical for households. Both the prepared and unprepared trout fillet, pork and turkey meat samples were stored temporarily in the laboratory until they were analysed. All unprepared samples were analysed for around 20 pharmacologically active substances each.

If pharmacologically active substances were detected in an unprepared sample (level ≥ **limit of detection**), the corresponding prepared sample was also analysed. This concerned a total of 31 samples, including 18 trout fillet samples, one pork sample and twelve turkey meat samples.

Residues in measurable levels were found (level ≥ **limit of quantification**) in a total of 19 of the 180 unprepared samples analysed. The levels of residues in these samples were on average 18% and a maximum of 36% of the respective maximum residue limit.

A total of 3,783 individual results were included in the evaluation, which were distributed relatively evenly among the trout fillet, pork and turkey meat samples. Approximately 99 % of the individual results of the unprepared samples showed no detectable or determinable levels of the analysed substances. A summary of the test results of the trout fillet, turkey and pork samples can be found in Tables 1 to 3.

Typical household preparation of the samples had no significant influence on the levels of the substances considered in the 18 trout fillet samples, the pork sample and the twelve turkey meat samples analysed.

All results of the "pharmacologically active substances" module are now available to the public as a "*Public Use File*": www.bfr-meal-studie.de/de/public-use-file.html

Table 1 Summary of the results of the analysed samples of trout fillet (UB; unprepared).

UB: *Upper* Bound *approach*
LOD: *Limit of* Detection
LOQ: *Limit of Quantification*
N: Number of samples
[a] enrofloxacin, oxytetracycline and trimethoprim were present together in one sample; [b] enrofloxacin and sulfadiazine were present together in one sample; [c] sulfadiazine and trimethoprim were present together in five samples; [d] as the sum of the substances; [e] as the sum of the substances of the sulfonamide group.
Maximum residue limits are reported here for information purposes; the values in the respective legal texts are binding.

substance	LOD (µg/kg)	LOQ (µg/kg)	N	N (< LOD)	N (≥ LOD to < LOQ)	N (≥ LOQ)	Measured values ≥ LOQ (µg/kg)	Maximum residue limit (µg/kg)
Chlortetracycline	3	10 - 11	60	60	0	0	-	100
Ciprofloxacin	3	10 - 11	60	60	0	0	-	100[d]
Danofloxacin	3	10 - 11	60	60	0	0	-	100
Doxycycline	3	10 - 11	60	60	0	0	-	100
Enrofloxacin	3	10 - 11	60	57	1[a]	2[b]	17 and 36	100[d]
Erythromycin A	7 - 8	20 - 23	60	60	0	0	-	200
Florfenicol	2	6 - 7	60	60	0	0	-	1000
Gamithromycin	7 - 8	20 - 23	60	60	0	0	-	not listed
Marbofloxacin	3	10 - 11	60	60	0	0	-	not listed
Oxytetracycline	3	10 - 11	60	59	1[a]	0	-	100
Sulfadiazine	2	6 - 7	60	50	7[b,c]	3	7.3 to 12	100[e]
Sulfadimethoxine	2	6 - 7	60	60	0	0	-	100[e]
Sulfadimidine (sulfamethazine)	2	6 - 7	60	60	0	0	-	100[e]
Sulfadoxine	2	6 - 7	60	60	0	0	-	100[e]
Sulfathiazole	2	6 - 7	60	60	0	0	-	100[e]
Tetracycline	3	10 - 11	60	60	0	0	-	100
Tildipirosin	7 - 8	20 - 23	60	60	0	0	-	not listed
Tilmicosin	7 - 8	20 - 23	60	60	0	0	-	50
Trimethoprim	2	6 - 7	60	48	6[a,c]	6[c]	6.2 to 17	50
Tulathromycin	7 - 8	20 - 23	60	60	0	0	-	not listed
Tylosin	7 - 8	20 - 23	60	60	0	0	-	100

Table 2: Summary of the results of the analysed samples of turkey meat (UB; unprepared).

UB: *Upper* Bound *approach*
LOD: *Limit of* Detection
LOQ: *Limit of Quantification*
N: Number of samples
[a] as the sum of the substances;[b] as the sum of the substances of the sulfonamide group.
Maximum residue limits are reported here for information purposes; the values in the respective legal texts are binding.

substance	LOD (µg/kg)	LOQ (µg/kg)	N	N (< LOD)	N (≥ LOD to < LOQ)	N (≥ LOQ)	Measured values ≥ LOQ (µg/kg)	Maximum residue limit (µg/kg)
Chlortetracycline	3	10 - 11	60	60	0	0	-	100
Ciprofloxacin	3	10 - 11	60	60	0	0	-	100[a]
Danofloxacin	3	10 - 11	60	60	0	0	-	100
Doxycycline	3	10 - 11	60	55	1	4	12 to 31	100
Enrofloxacin	3	10 - 11	60	55	4	1	12	100[a]
Lasalocid	2	5 - 6	60	60	0	0	-	60
Maduramycin	2	5 - 6	60	60	0	0	-	30
Marbofloxacin	3	10 - 11	60	60	0	0	-	not listed
Monensin	2	5 - 6	60	60	0	0	-	not listed
Narasin	2	5 - 6	60	60	0	0	-	50
Nicarbazin calculated as dinitrocarbanilide	2	5 - 6	60	60	0	0	-	4000
Oxytetracycline	3	10 - 11	60	60	0	0	-	100
Sulfadiazine	2	6 - 7	60	60	0	0	-	100[b]
Sulfadimethoxine	2	6 - 7	60	60	0	0	-	100[b]
Sulfadimidine (sulfamethazine)	2	6 - 7	60	60	0	0	-	100[b]
Sulfadoxine	2	6 - 7	60	60	0	0	-	100[b]
Sulfathiazole	2	6 - 7	60	60	0	0	-	100[b]
Tetracycline	3	10 - 11	60	60	0	0	-	100
Toltrazurilsulfone	2	5 - 6	2	0	0	2	11 and 19	100

Table 3: Summary of the results of the pork samples analysed (UB, unprepared).

UB: *Upper* Bound *approach*
LOD: *Limit of* Detection
LOQ: *Limit of Quantification*
N: Number of samples
[a] as the sum of the substances;[b] as the sum of the substances of the sulfonamide group.
Maximum residue limits are reported here for information purposes; the values in the respective legal texts are binding.

substance	LOD (µg/kg)	LOQ (µg/kg)	N	N (< LOD)	N (≥ LOD to < LOQ)	N (≥ LOQ)	Measured values ≥ LOQ (µg/kg)	Maximum residue limit (µg/kg)
Amoxicillin	8 - 9	25 - 28	60	60	0	0	-	50
Chlortetracycline	3	10 - 11	60	60	0	0	-	100
Ciprofloxacin	3	10 - 11	60	60	0	0	-	100[a]
Danofloxacin	3	10 - 11	60	60	0	0	-	100
Dihydrostreptomycin	7 - 8	20 - 22	60	60	0	0	-	500
Doxycycline	3	10 - 11	60	60	0	0	-	100
Enrofloxacin	3	10 - 11	60	60	0	0	-	100[a]
Gentamycin	8 - 9	25 - 28	60	60	0	0	-	50
Marbofloxacin	3	10 - 11	60	60	0	0	-	150
Neomycin	8 - 9	25 - 28	60	60	0	0	-	500
Oxytetracycline	3	10 - 11	60	60	0	0	-	100
Penicillin G	8 - 9	25 - 28	60	60	0	0	-	50
Spectinomycin	17 - 19	50 - 55	60	60	0	0	-	300
Streptomycin	7 - 8	20 - 22	60	60	0	0	-	500
Sulfadiazine	2	6 - 7	60	60	0	0	-	100[b]
Sulfadimethoxine	2	6 - 7	60	60	0	0	-	100[b]
Sulfadimidine (sulfamethazine)	2	6 - 7	60	59	0	1	16	100[b]
Sulfadoxine	2	6 - 7	60	60	0	0	-	100[b]
Sulfathiazole	2	6 - 7	60	60	0	0	-	100[b]
Tetracycline	3	10 - 11	60	60	0	0	-	100

Further information

Information on the BfR MEAL study
http://www.bfr-meal-studie.de/en/meal-homepage.html

Residues of Pharmacological substances and Contaminations from animal foods
https://www.bfr.bund.de/en/residues_of_pharmacological_substances_and_contaminations_from_animal_foods-1835.html

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. The BfR advises the Federal Government and the States (‘Laender’) on questions of food, chemicals and product safety. The BfR conducts independent research on topics that are closely linked to its assessment tasks.

BfR MEAL study

What is the average intake of desirable and undesirable substances in our diet? Are certain foods more contaminated? And what health effects does the species of preparation have on the food? The BfR MEAL study helps to answer these and other questions.

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