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STATEMENT

Animal dietary exposure in the risk assessment of contaminants in feed

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Abstract

EFSA performs dietary exposure assessments for food-producing and non-food-producing animals to deliver risk assessment for mandates on the presence of contaminants in feed. The CONTAM and FEEDAP Panels identified the need to update the animal dietary exposure assessment model used in those assessments in CONTAM Scientific Opinions since 2011 in cases where insufficient occurrence data are available on species specific compound feeds. The Panels proposed in this statement a series of model diets based on groups of feed materials with the possibility to use different feed materials in their formulation. The Panels considered that the currently proposed model diets cover the need of the CONTAM Panel to assess the dietary exposure of animals to contaminants in feed.

KEYWORDS

animal dietary exposure, complete feed, contaminants, diets, feed materials

CONTENTS

1 | INTRODUCTION

1.1 | Background and Terms of Reference

The risk assessments within the frame of generic mandates from the European Commission (EC) regarding contaminants may require the study of the exposure of animals to those contaminants via contaminated feed materials. The model scenarios that are currently being used in the area of contaminants consider the total daily feed intake and the composition of complete feed for different animal species/categories as detailed in the Scientific Opinion on the risks for animal and public health related to the presence of T-2 and HT-2 toxin in food and feed (EFSA CONTAM Panel, 2011).

In the context of on-going work, it has been identified that some of the default values for feed intake and the composition of the complete feeds that are currently used in the exposure scenarios may not reflect current animals' characteristics and/or feeding practices (e.g. current use of feed materials in the diets). Therefore, the CONTAM Panel in collaboration with the FEEDAP Panel have identified the need for a re-elaboration of the model in use for animal dietary exposure assessment to ensure it is up-to-date and reflects current feeding practices. The aim for a re-elaboration of the model is to derive an up-to-date mod and to provide a more flexible approach to allow to perform streamline animal dietary exposure assessments.

In view of the above, the European Food Safety Authority (EFSA) asks the FEEDAP and CONTAM Panels to update the model currently in use for animal dietary exposure assessment to ensure it is up to date with the current practices (e.g. updated animal diets in line with current recommended diets) and allowing a more flexible approach.

1.2 | Aim of the statement

The aim of this statement is to report the proposed animal dietary exposure scenarios and to describe the scientific rationale on which the exposure scenario is based.

1.3 | Additional information

When assessing the exposure of the animals to feed contaminants, if occurrence data in compound feed[1] are available (sufficient amount and quality), then the exposure is assessed using the compound feeds. However, when insufficient data for compound feed are available, the animal exposure is estimated using model diets composed of different feed materials for which occurrence data on the relevant contaminant is present.

The CONTAM Panel has used default values for average feed intakes, body weights and model diet composition to calculate animal dietary exposure to various contaminants based on published guidelines on nutrition and feeding, and extensively described by the CONTAM Panel in previous Scientific Opinions on the risks for animal health (EFSA CONTAM Panel, 2011, 2012). In May 2023, the CONTAM Panel already started modifying/updating the above default values in line with current common practices and published guidelines. The amendments introduced in May 2023 were also aimed at allowing a certain flexibility in the use of interchangeable feeding materials in relation to occurrence data availability and levels of contamination. With this scope, feed groups were identified, in line with Commission Regulation (EU) 2022/1104,[2] and within each group, feed materials could be exchanged, provided the nutritional needs of the various animal species are met.

The update of this approach, scope of the current assessment, is crucial to align with contemporary feeding practices, incorporating updated animal diets in accordance with current recommendations and utilisation patterns.

EFSA is also involved in a project which aims to conduct preparatory work for a potential further implementation of a harmonised feed classification system and the development of a European Union feed consumption database. The project, led by the GMO Unit and run under procurement OC/EFSA/GMO/2021/05 'Feed classification and feed consumption database', is looking to develop a preliminary feed consumption database model, including case studies from Opinions of the GMO and CONTAM Panels. It is deemed that the Panel statement report does not interfere or overlap with the above-mentioned GMO project, due to the different remits. However, once available, the CONTAM and FEEDAP Panels will be able to take the feed consumption database on board for animal dietary exposure assessments.

1.4 | Consultation with feed industry associations

EFSA invited two feed industry associations FEDIAF (European Pet Food Association) and FEFAC (European Feed Manufacturers' Federation) to comment on the proposed model diets to be used in the animal exposure assessments performed by the CONTAM and FEEDAP Panels for food-producing and non-food-producing animals. The aim of the ad hoc

[1] i.e. a mixture of at least two feed materials, whether or not containing feed additives, for animal feeding in the form of complete or complementary feed.

[2] Commission Regulation (EU) 2022/1104 of 1 July 2022 amending Regulation (EU) No 68/2013 on the Catalogue of feed materials (Text with EEA relevance), C/2022/4474, OJ L 177, 4.7.2022, pp. 4–74.

stakeholder meetings was to discuss the tables with animal diets reflecting the current situations in the feed market and preparation of model diets in the most realistic way.

2 | DATA AND METHODOLOGIES

2.1 | Data

The CONTAM and FEEDAP Panels used the default values for body weight and feed intake of the food and non-food-producing animals reported in the FEEDAP Panel guidance on the safety for the target species (EFSA FEEDAP Panel, 2017) and, when necessary, the values available in published guidelines on nutrition and feeding and in other scientific publications, already described in Opinions adopted by the CONTAM Panel (EFSA CONTAM Panel, 2023, 2024). These default values are reported in Appendix A.

Data on current typical inclusion levels of different feed materials in diets for dogs and cats were made available by FEDIAF and in feed for salmonids by FEFAC and are included in Annex A.

2.2 | Methodology

2.2.1 | Animal exposure assessment methodology

In the context of the CONTAM Panel risk assessments for animals, the dietary exposure assessment is performed using different scenarios, based on the available occurrence data of the relevant contaminant. In particular, two scenarios are generally considered: a mean occurrence scenario, in which the mean lower bound (LB) and upper bound (UB) values for each feedingstuff are used to estimate dietary concentrations; and a high occurrence scenario, in which the highest reliable percentile LB and UB values are used, up to the 95th percentile (EFSA CONTAM Panel, 2014). The calculated mean and high concentrations in the diet may be combined with the estimated feed intake and body weight to obtain the estimated dietary exposure of the different animal species and categories in the two scenarios, expressed in mg per kg bw per day. In general, however, the CONTAM Panel derives Reference Points for adverse animal health effects expressed per kg complete feed, therefore dietary exposure is also expressed as per kg complete feed.

2.2.2 | Animal species and categories used for exposure estimates

A multitude of animal species are defined in the EU legislation, covering both food-producing and non-food-producing animals. The number of animals kept for production varies largely, as well as the different diets formulated and fed according to their nutrient requirements. Some diets are standardised (e.g. chickens for fattening, laying hens, pigs for fattening), others are to a lesser extent (e.g. ducks, geese, ruminants).

The most comprehensive list of animal species/categories, which would be affected by the approach described in the current assessment, is reported in Regulation (EC) No 429/2008, which lists in Annex IV the following categories of food-producing and non-food-producing animals:

- Pigs: piglets (suckling, weaned, suckling and weaned), pigs for fattening, sows for reproduction;
- Poultry: chickens for fattening, chickens reared for laying, laying hens, turkeys for fattening, turkeys reared for breeding, turkeys for breeding;
- Bovines: calves for rearing, calves for fattening, cattle for fattening, dairy cows, cows for reproduction;
- Sheep: lambs for rearing, lambs for fattening, dairy sheep, ewes for reproduction;
- Goats: kids for fattening, dairy goats, goats for reproduction;
- Fish: salmon and trout, salmon and trout (brood stock);
- Rabbits: rabbits suckling and weaned, rabbits for fattening, breeding does (for reproduction), breeding does (in order to have benefits for young rabbits);
- Horses: horses (all categories);
- Dogs and cats.

In addition to these animal species/categories, the CONTAM Panel might consider also other/minor animal species (e.g. ducks, guinea fowl, fin fish other than salmon and trout), and different production systems (e.g. high zootechnical performance, low zootechnical performance, grazing systems).

Model diets for such an extended list of animals would be questionable concerning its accuracy and reliability. For the animal species/categories which are kept and fed in several millions in Europe, nutrient requirements are well known, and mostly internationally standardised. However, for animal species/categories farmed in small numbers, regional preferences and availability of feed materials would determine diet composition. Consequently, accuracy of an exposure estimate would considerably decrease. On the other hand, when the largely available main feed materials are used, there would not

be essential differences in feed materials used for feed manufacturing between species of growing and laying poultry, or of growing and lactating ruminants.

A restriction of the list of animal species and categories, for which an exposure estimate based on model diets is performed, appears consequently reasonable and necessary. The selection should also consider animal species with a high feed intake (high zootechnical performance).

The CONTAM and FEEDAP Panels agreed to use, and therefore to develop, model diets for the following animal species and categories: piglets, pigs for fattening, lactating sows, chickens for fattening, laying hens, turkeys for fattening, calves (milk replacer), cattle for fattening, dairy cows, lambs for fattening, fish (salmon or trout), rabbits, horses, dogs (dry food), cats (dry food).

The restriction of the list of animal species and categories for which an exposure estimate based on model diets is performed does not hinder the risk characterisation for the other animal categories/species as the exposure can be estimated from the concentration of contaminants in feed calculated for the related species/categories.

2.2.3 | Feed materials used to develop model diets

The feed materials used to develop model diets are those listed in Part C of the Annex of Commission Regulation (EU) No 68/2013.[3] In the above mentioned Annex, the feed materials are divided in 13 groups, based on their origin, and are briefly described. Among all the feed materials listed in the above regulation, those more commonly used when formulating diets were selected. The selected feed materials used in the current assessment to develop the model diets are listed in Appendix B.

2.2.4 | Development of model diets

The cornerstone of the current proposed approach for the estimate of the animal exposure is the formulation of the diets based on groups of feed materials (Appendix B). The diet for each animal species was defined in terms of groups of feed materials (e.g. cereal grains and products derived thereof; oil seeds, oil fruits and products derived thereof), in order to provide the adequate nutrients, even if at a very high level. This is the basis which remains constant in each further assessment. Nevertheless, in order to guarantee the flexibility that is necessary to meet the requirement of each specific assessment, the composition of feed materials can vary within each group. It was considered that within each group of feed materials, it will be possible to include one or more of the relevant feed materials of the group, depending on the need (i.e. occurrence of contaminants reported only in specific feed materials). This would allow the possibility to substitute 100% of the constituents of the diets, maintaining them nutritionally adequate. As an example, the model diet for chickens for fattening would be composed of 75% cereal grains and products derived thereof, 20% oil seeds, oil fruits and products derived thereof, 2% tubers, roots and products derived thereof, 2.5% minerals and products derived thereof and 0.5% feed additives. As an example, a simple diet formulated with feed materials that fits this model could be composed of 75% wheat, 20% soybean meal, 2% molasses and 3% trace elements and feed additives. While in case of need, many more feed materials could be included, or each of those listed above could be substituted by another one in the same group.

The choice of having diets based on the groups of feed materials, with the individual components that can be changed and replaced by each other, is the answer to the needs of the CONTAM Panel (i) to be flexible with the use of the feed materials, for which the presence of occurrence data of contaminants could be very different among the different assessments; (ii) to be able to assess, if relevant, the worst-case exposure scenario (i.e. to consider that the feed materials, for which the highest concentration of a specific contaminant is reported, are included in the diets of all the relevant animal species at the highest possible inclusion level).

3 | PROPOSED MODEL DIETS

The model diets developed by the CONTAM and FEEDAP Panels are reported in Appendix C.

The diets are presented in two main ways, one reporting the defined composition in terms of groups of feed materials and one with an example of a diet formulated with some of the feed materials for each group (see Section 2.2.4). The Panels note that the proposed model diets formulated with the feed materials could be considered as examples, presented to show the flexibility of the diets, and that the specific diets included in any future assessment might be different from the ones proposed.

The diets developed for poultry species/categories (chickens for fattening, laying hens and turkeys for fattening), for pig species/categories (piglets, pigs for fattening, lactating sows), for veal calves (based on milk replacer), for rabbits, and for dogs and cats are in the form of complete feed (i.e. mixtures of feedingstuffs which, by reason of their composition, are sufficient for a daily ration). The diets for dogs and cats, in addition, are representative of dry feed only, since the variability in dry matter content and composition of the high moisture diets (e.g. canned food) would not allow a reliable estimate

[3]As amended by Commission Regulation (EU) 2022/1104.

of the exposure. For dogs, considering the increasing presence on the market of diets without meat and fish and their by-products (hereafter referred to as vegetarian diets) a specific model vegetarian diet was also considered.

The model diets for cattle for fattening, dairy cows, lambs for fattening and horses are instead presented as complementary feed (i.e. compound feed which has a high content of certain substances but which, by reason of its composition, is sufficient for a daily ration only if used in combination with other feed) because these diets should be complemented with forages in order to provide the complete daily ration.

As for the other feed materials considered in this assessment, forages are defined as a group of feed materials (Appendix B) and the choice of the specific forage to be used will follow the same rationale as for the other feed materials. When considering the inclusion of forages in the diets for ruminants and horses, the CONTAM and FEEDAP Panels also established a specific complementary feed to forage ratio. For dairy cows, the ratio selected is representing the diet of high yielding dairy cows. For ruminants for fattening, in order to represent the two major farming systems present in Europe (feedlot (high complementary feed/low forage) and pasture/forage-based diets (low complementary feed/high forage)), two extreme ratios were selected. For horses, the ratio chosen is representing the one used in their most common farming system.

4 | UNCERTAINTY AND LIMITATIONS

The identification of uncertainty and limitations influencing the dietary exposure assessment is central to understanding the limitations of the current model diets. The CONTAM and FEEDAP Panels have discussed the uncertainty/limitations throughout this appraisal and identified the following aspects as the main contributors:

- The absence of a European Union feed consumption database, which would allow to estimate animal dietary exposure in a similar manner as human dietary exposure[4];
- The model diets do not cover all the feeding regimes in the EU due to the variability of the feeding practices.

Overall, the approach described in this Statement is designed to allow a conservative approach, which could be used, if necessary, to represent a worst-case scenario for the exposure to contaminants in animal diets.

5 | CONCLUSIONS

The CONTAM and FEEDAP Panels considered that the currently proposed model diets, based on groups of feed materials and the possibility to use different feed materials, when needed, cover the need of the CONTAM Panel to assess the dietary exposure of animals to feed contaminants, limiting the uncertainty to an adequate level.

6 | DOCUMENTATION AS PROVIDED TO EFSA

Data on current typical inclusion levels of different feed materials in diets for dogs and cats were discussed with experts from FEDIAF and provided to EFSA by email on 24th April 2024 (Annex A).

ABBREVIATIONS

bw	body weight
CF	complete feed
CONTAM	EFSA Panel on Contaminants in the Food Chain
DDG	Distiller's dried grains
DDGS	Distiller's dried grains with soluble
DM	dry matter
FEEDAP	EFSA Panel on Additives and Products or Substances used in Animal Feed
LB	lower bound
UB	upper bound

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[4]https://www.efsa.europa.eu/en/data-report/food-consumption-data#the-efsa-comprehensive-european-food-consumption-database.

AMENDMENT NOTE

A spelling mistake in Guido Rychen surname was rectified. An editorial correction was carried out that does not materially affect the contents or outcome of this scientific output. To avoid confusion, the original version of the output has been removed from the EFSA Journal, but is available on request.

CONFLICT OF INTEREST

If you wish to access the declaration of interests of any expert contributing to an EFSA scientific assessment, please contact interestmanagement@efsa.europa.eu.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX A

Intake and default body weight composition of diets used to estimate animal exposure

TABLE A1 Default values for live weight and feed intake of ruminants and horses.

	Live weight (kg)	Feed intake (kg/day)		Reference
		Dry matter	Complete feed[a]	
Cattle				
Dairy cows	650	20.0	22.7	EFSA FEEDAP Panel (2017)
Cattle for fattening	400	8.0	9.1	EFSA FEEDAP Panel (2017)
Veal calves	100	1.89	2.0[b]	EFSA FEEDAP Panel (2017)
Small ruminants				
Dairy sheep/goats	70	2.2	3.5	EFSA FEEDAP Panel (2017)
Lambs for fattening	20.0	0.88	1.0	NRC (2007)
Horses	400	8.00	9.1	EFSA FEEDAP Panel (2017)

[a]88% dry matter.
[b]Milk replacer (94.5% dry matter).

TABLE A2 Default values for live weight and feed intake of pigs, poultry, fish and rabbits.

	Live weight (kg)	Feed intake (kg/day)		Reference
		Dry matter	Complete feed[a]	
Pigs				
Piglets (weaned)	20	0.88	1.0	EFSA FEEDAP Panel (2017)
Pigs for fattening	60	2.20	2.5	EFSA FEEDAP Panel (2017)
Sows, lactating	175	5.28	6.0	EFSA FEEDAP Panel (2017)
Poultry				
Chickens for fattening	2.0	0.158	0.18	EFSA FEEDAP Panel (2017)
Laying hens	2.0	0.106	0.12	EFSA FEEDAP Panel (2017)
Turkeys for fattening	3.0	0.176	0.20	EFSA FEEDAP Panel (2017)
Fish				
Salmon	0.12	0.0021	0.0024	EFSA FEEDAP Panel (2017)
Rabbits				
Rabbits for fattening	2.0	0.10	0.114	EFSA FEEDAP Panel (2017)

[a]88% dry matter.

TABLE A3 Default values for live weight and feed intake of dogs and cats.

	Live weight (kg)	Feed intake (kg/day)		Reference
		Dry matter	Complete feed[a]	
Dogs	15	0.25	0.284	EFSA FEEDAP Panel (2017)
Cats	3	0.06	0.068	EFSA FEEDAP Panel (2017)

[a]88% dry matter.

APPENDIX B

Groups of feed materials

The list identifies which feed materials could be considered when the groups of feed materials are attributed to a compound feed for target animals.

Cereal grains and products derived thereof

Barley, maize, oats, broken rice, rye, triticale, wheat.
By-products: From dry milling: middling's, feed, flakes, bran, hulls.
From wet milling: starch, germ meal, gluten feed, gluten.
From fermentation: DDG, DDGS, brewer's grains.

Oil seeds, oil fruits, and products derived thereof

Cotton seed, linseed, rape seed, soya beans, sunflower seed.
Main products: Expeller, solvent extracted meal, extruded/toasted beans, flakes.
By-products: Hulls, protein concentrate.

Legume seeds and products derived thereof

Beans, lentils, sweet lupins, peas.
By-products: Protein/protein concentrate, germ, flakes, hulls.

Tubers, roots, and products derived thereof

Sugar beet, potatoes.
By-products: Molasses, beet pulp, protein, inulin.

Other seeds and fruits, and products derived thereof

Acorn, almond, buckwheat, red clover seed, white clover seed.
By-products: Apple pulp, citrus pulp, grape pulp, middling's, bran/hulls, pectin.

Forages and roughage, and products derived thereof

Beet leaves, green silage, grass, lucerne (alfalfa) meal, hay, straw, maize silage.

Other plants, algae, fungi and products derived thereof

Algae, seaweed, fungi.
By-products: Sugar cane molasses, cellulose.

Milk products and products derived thereof

Butter, buttermilk, skimmed milk powder, whey/whey powder, delactosed (and demineralised) whey, casein, whey protein, lactose, whey permeate.

Land animal products and products derived thereof

Animal by products, animal fat, blood meal, feather meal, gelatine, egg products, dried, terrestrial invertebrates.

Fish, other aquatic animals and products derived thereof

Crustacea meal, fish meal, fish solubles, fish protein, fish oil, krill protein concentrate.
Minerals and products derived thereof.

Products and co-products obtained by fermentation using microorganisms

Yeast (brewer's yeast), single cell protein (bacterial or fungal origin).

Miscellaneous

Products from the bakery and pasta industry, fruit syrup, dextrose, fructose, xylose, lactulose, gluco/fructo-oligosaccharides, starch, dextrins, sorbitol, fatty acids esterified with glycerol, soap stocks, glycerine, propylene glycol, chondroitin sulphate.

APPENDIX C

Model diets for the main animal species and categories

The groups of feed materials listed in the Tables C1–C10 are defined in Part C of the Annex of Commission Regulation (EU) No 68/2013, as amended by Commission Regulation (EU) 2022/1104. The diets presented with the percentage of the specific feed materials ('Proposed model diet composition' columns) are proposed model diets that can be considered example diets).

TABLE C1 Composition of complete feed for chickens, turkeys and laying hens.

	% of diet				Proposed model diet composition (%)		
	Chickens	Turkeys			Chickens	Turkeys	
Groups of feed materials	For fattening		Laying hens	Feed materials	For fattening		Laying hens
Cereal grains and products derived thereof	75	65	65	Wheat	38	30	30
				Wheat feed	1	–	–
				Wheat middlings	–	–	10
				Barley	–	35	–
				Maize	36	–	25
Oil seeds, oil fruits and products derived thereof	20	20	20	Soyabean meal	15	16	10
				Rapeseed	–	–	8
				Vegetable oils and fats	5	4	2
Tubers, roots, and products derived thereof	2	2	3	Molasses	2	2	3
Forage dehydrated		10	2	Lucerne meal	–	10	2
Minerals and products derived thereof	2.5	2.5	9.5	Mineral salts	2.5	2.5	9.5
Feed additives	0.5	0.5	0.5	Premix	0.5	0.5	0.5

TABLE C2 Composition of complete feed for piglets, pigs for fattening and lactating sows.

	% of diet				Proposed model diet composition (%)		
Groups of feed materials	Piglets	Pigs	Lactating sows	Feed materials	Piglets	Pigs	Lactating sows
Cereal grains and products derived thereof	68	77	75	Wheat	48	48	50
				Wheat feed	–	9	14
				Barley	20	20	11
Oil seeds, oil fruits and products derived thereof	26	16	18	Soyabean meal	22	11	16
				Rapeseed meal	3	4	–
				Vegetables oils and fats	1	1	2
Tubers, roots, and products derived thereof	3	4	4	Molasses	3	4	4
Minerals and products derived thereof	2.5	2.5	2.5	Mineral salts	2.5	2.5	2.5
Feed additives	0.5	0.5	0.5	Premix	0.5	0.5	0.5

TABLE C3 Composition of complementary feed for cattle.

Groups of feed materials	% of diet		Feed materials	Proposed model diet composition (%)	
	Dairy cows	Cattle for fattening		Dairy cows	Cattle for fattening
Cereal grains and products derived thereof	55	60	Wheat	15	–
			Wheat feed	10	10
			Barley	20	40
			Maize protein feed	10	10
Oil seeds, oil fruits and products derived thereof	26	22	Soyabean meal	5	–
			Rapeseed meal	20	20
			Vegetable oils and fats	1	2
Tubers, roots, and products derived thereof	11	15	Sugar beet pulp	8	12
			Molasses	3	3
Legume seeds and products derived thereof	5		Beans	5	–
Minerals and products derived thereof	2.5	2.5	Mineral salts	2.5	2.5
Feed additives	0.5	0.5	Premix	0.5	0.5

TABLE C4 Composition of complementary feed for lambs for fattening.

Groups of feed materials	% of diet	Feed materials	Proposed model diet composition (%)
Cereal grains and products derived thereof	67	Wheat feed	10
		Barley	20
		Oats	37
Oil seeds, oil fruits and products derived thereof	20	Soybean meal	10
		Rapeseed meal	8
		Vegetables oils and fats	2
Tubers, roots, and products derived thereof	5	Sugar beet pulp	2
		Molasses	3
Legume seeds and products derived thereof	5	Beans	5
Minerals and products derived thereof.	2.5	Mineral salts	2.5
Feed additives	0.5	Premix	0.5

TABLE C5 Composition of complementary feed for horses.

Groups of feed materials	% of diet	Feed materials	Proposed model diet composition (%)
Cereal grains and products derived thereof	82	Oat	40
		Oat feed	12
		Wheat feed	30
Tubers, roots, and products derived thereof	5	Molasses	5
Legume seeds and products derived thereof	10	Beans	10
Minerals and products derived thereof	2.5	Mineral salts	2.5
Feed additives	0.5	Premix	0.5

TABLE C6 Composition of complete feed for rabbits for fattening.

Groups of feed materials	% of diet	Feed materials	Proposed model diet composition (%)
Cereal grains and products derived thereof	25	Wheat	10
		Maize	5
		Wheat middlings	10
Forage dehydrated	20	Alfalfa meal	20
Oil seeds, oil fruits and products derived thereof	30	Sunflower meal	20
		Soyabean meal	3
		Soya (bean) hulls	7
Tubers, roots, and products derived thereof	20	Sugar beet pulp	18
		Molasses	2
Land animal products and products derived thereof	2	Fat	2
Minerals and products derived thereof	2.5	Mineral salts	2.5
Feed additives	0.5	Premix	0.5

TABLE C7 Composition of complete feed for salmonids.

Groups of feed materials	% of diet	Feed materials	Proposed model diet composition (%)
Cereal grains and products derived thereof	15	Wheat, pre-gelatinised	10
		Maize protein	5
Oil seeds, oil fruits, and products derived thereof	22	Soya (bean) meal	7
		Sunflower meal	5
		Rape seed meal	3
		Vegetable oil	7
Legume seeds and products derived thereof	7	Beans	4
		Peas	3
Land animal products and products derived thereof	28	Animal by-products	15
		Feather meal	5
		Blood meal	5
		Animal fat	3
Fish, other aquatic animals and products derived thereof	22	Fish meal	15
		Fish oil	7
Minerals and products derived thereof	2	Mineral salts	2
Feed additives	4	(mainly amino acids)	4

TABLE C8 Composition of complete feed for dogs.

	% of diet			Proposed model diet composition (%)	
Groups of feed materials	With meat /fish	Vegetarian	Feed materials	With meat /fish	Vegetarian
Land animal products and products derived thereof/**fish**, other aquatic animals and products derived thereof[a]	35	–	**Animal products**[a]	30	–
			Fat/oil	5	–
Cereal grains and products derived thereof	45	45	Rice	20	35
			Oats	10	–
			Wheat	10	5
			Wheat protein	5	5
Oil seeds, oil fruits and products derived thereof	10	20	Sunflower meal	–	5
			Soybean meal	7	10
			Vegetable oil and fat	3	5

(Continues)

TABLE C8 (Continued)

Groups of feed materials	% of diet		Feed materials	Proposed model diet composition (%)	
	With meat /fish	Vegetarian		With meat /fish	Vegetarian
Tubers, roots, and products derived thereof	5	15	Sugar beet pulp	5	5
			Potato protein	–	10
Forages and roughage, and products derived thereof	2	2	Herbs	2	2
Legume seeds and products derived thereof	–	10	Peas	–	5
			Carobs	–	5
Milk products and products derived thereof	–	5	Milk protein powder	–	5
Minerals and products derived thereof	2.5	2.5	Mineral salts	2.5	2.5
Feed additives	0.5	0.5	Premix	0.5	0.5

[a]Could be represented by e.g. aquatic invertebrates, fish, fishmeal or animal by-products, hydroylsed animal proteins, blood meal, feather meal.

TABLE C9 Composition of complete feed for cats.

Groups of feed materials	% of diet	Feed materials	Proposed model diet composition (%)
Land animal products and products derived thereof/fish, other aquatic animals and products derived thereof	40	Animal products[a]	35
		Fat	5
Cereal grains and products derived thereof	30	Rice	20
		Wheat protein	10
Oil seeds, oil fruits and products derived thereof	5	Soybean meal	5
Tubers, roots, and products derived thereof	12	Sugar beet pulp	5
		Potato protein	7
Legume seeds and products derived thereof	10	Peas	9
		Carobs	1
Minerals and products derived thereof	2.5	Mineral salts	2.5
Feed additives	0.5	Premix	0.5

[a]Could be represented by e.g. aquatic invertebrates, fish, fishmeal or animal by-products, hydroylsed animal proteins, blood meal, feather meal.

TABLE C10 Complementary feed to forage ratios (on dry matter basis) for ruminants and horses.

	% Complementary feed dry matter (DM)	% forage DM
Dairy cows	60	40
Ruminants for fattening		
High complementary feed/low forage	80	20
Low complementary feed/high forage	20	80
Horses	25	75

ANNEX A

Data on current typical inclusion levels of different feed materials in diets for dogs and cats

The data on current typical inclusion levels of different feed materials in diets for dogs and cats provided by FEDIAF can be found in the online version of the output ('Supporting information' section) at: https://doi.org/10.2903/j.efsa.2024.8858.