



Concern about double-counting of enzyme exposure in FEIM models

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Enzymes used in more food processes → risk of double-counting dietary exposure

When an enzyme is used in several food processes for the same activity, there is a risk of double-counting dietary exposure, because the same foods are listed in several FEIM models

Double-counting may lead to:

Overestimated dietary exposure



Underestimated margin of exposure (MoE)



Risk of inconclusive opinion

Example – Proteases used in food processing

Introduction

- Proteases (mentioned as 'Peptidases' in COM/EFSA guidances) catalyse hydrolysis of proteins into protein hydrolysates, i.e. peptides and amino acids
- Protein hydrolysates from various protein sources (incl. whey, cheese, meat/fish trimming, soy, gluten, yeast) are used in the food industry for various purposes, e.g. protein supplementation, taste improvement and/or improved mouth feel
- Protein hydrolysates do not have a specific, definite taste or flavour, but may provide an unspecific 'umami-like' or 'salty' impression when used as ingredients in final foods
- Protein hydrolysates produced from different raw materials can therefore be used interchangeably in final foods

Example – Proteases used in food processing

- Proteases ('Peptidases') are '*typical enzymes*' for use in 20 different food manufacturing processes
- Applying a protease in the relevant food processes will lead to double-counting of dietary exposure, because many of the same foods are listed in various FEIM models

'Peptidases' (proteases) described as typical enzymes for use in 20 different food manufacturing processes in COM guidance:

- 01. Processing of dairy products
 - 01.02 Production of cheese
 - 01.03 Production of fermented dairy products
 - 01.04 Production of flavouring preparation from dairy products
 - 01.05 Production of whey concentrates and whey protein isolates
 - 01.06 Production of whey protein hydrolysates
- 02. Processing of eggs and egg products
- 03. Processing of meat and fish products
 - 03.01 Production of modified meat and fish
 - 03.02 Production of protein hydrolysates from meat & fish protein isolates
- 04. Processing of cereals and other grains
 - 04.02 Production of starch and gluten fractions
 - 04.03 Production of baked products
 - 04.04 Production of cereal-based products other than baked
 - 04.05 Production of brewed products
 - 04.07 Production of distilled alcohol
- 05. Processing of fruit and vegetables
 - 05.02 Production of fruit and vegetable products other than juices
 - 05.03 Production of wine and wine vinegar
- 06. Processing of plant-derived products
 - 06.06 Production of tea and other herbal and fruit infusions
 - 06.08 Production of plant-based analogues of milk and milk product
 - 06.09 Production of Soy sauce
 - 06.10 Production of protein hydrolysates from plants
- 07. Processing of yeast and yeast products

Some FEIM models relevant for proteases

- Several food processes and corresponding FEIM models relevant for proteases are based on protein from specific raw materials (plants, whey, yeast, fish/animal, cheese) rather than just 'protein'
- Because protein hydrolysates produced from various raw materials can be used interchangeably in various final foods, a certain protease must be applied for use in several food processes to cover the market needs, e.g. in the below 7 food processes:

EFSA #	EFSA Annex	COM #	Food process	FEIM Model (*: Under development)
3.4	4	01.04	Production of flavouring preparation from dairy products	FEIM_EMDI
3.5	5	01.05	Production of whey concentrates and whey protein isolates	FEIM_whey
3.6	6	01.06	Production of whey protein hydrolysates	FEIM_wheyHydrol*
3.8	8	03.01	Production of modified meat and fish	FEIM_meatFish*
3.9	9	03.02	Production of protein hydrolysates from meat and fish protein isolates	FEIM_proteinAnimal*
3.31	26	06.10	Production of protein hydrolysates from plants	FEIM_proteinPlant*
3.32	27	07.	Processing of yeast and yeast products	FEIM_yeast

Recurrent foods in FEIM models lead to double-counting of exposure

Input data for several FEIM models list many of the same foods (FoodEx categories)

The FEIM models for the before mentioned 7 food processes relevant for proteases list many of the same foods:

- **Total** number of foods/FoodEx listed in the 7 models: **743**
- Hereof, **same foods** listed in **2 models or more**: **509**
- With distribution of **same foods listed in**:

2 models:	164
3 models:	166
4 models:	141
5 models:	30
6 models:	8

The 7 exemplified food processes/FEIM models:

Food process

Production of flavouring preparation from dairy products

Production of whey concentrates and whey protein isolates

Production of whey protein hydrolysates

Production of modified meat and fish

Production of protein hydrolysates from meat and fish protein isolates

Production of protein hydrolysates from plants

Processing of yeast and yeast products

Example of same foods listed in 4 FEIM models

FoodEx2 code	Annex 8 - production of modified meat and fish products	Annex 9 - production of protein hydrolysates from meat and fish protein isolates	Annex 26 - production of protein hydrolysates from plants	Annex 27 - production of yeast and yeast products
A024H	Italian-style sausage	Italian-style sausage	Italian-style sausage	Italian-style sausage
A024K	Fresh bulk sausages	Fresh bulk sausages	Fresh bulk sausages	Fresh bulk sausages
A024L	Breakfast-type sausage	Breakfast-type sausage	Breakfast-type sausage	Breakfast-type sausage
A024M	Chipolata-type sausage	Chipolata-type sausage	Chipolata-type sausage	Chipolata-type sausage
A024P	Thuringian sausage	Thuringian sausage	Thuringian sausage	Thuringian sausage
A024R	Mettwurst-type sausage	Mettwurst-type sausage	Mettwurst-type sausage	Mettwurst-type sausage
A024S	Teewurst-type sausage	Teewurst-type sausage	Teewurst-type sausage	Teewurst-type sausage
A024T	Fresh kolbasz	Fresh kolbasz	Fresh kolbasz	Fresh kolbasz
A024V	Cured ripened raw sausages (unspecified)	Cured ripened raw sausages (unspecified)	Cured ripened raw sausages (unspecified)	Cured ripened raw sausages (unspecified)
A024X	Salami-type sausage (unspecified)	Salami-type sausage (unspecified)	Salami-type sausage	Salami-type sausage (unspecified)
A024Y	Italian-type salami	Italian-type salami	Italian-type salami	Italian-type salami
A024Z	Hungarian-type salami	Hungarian-type salami	Hungarian-type salami	Hungarian-type salami
A025A	German salami	German salami	German salami	German salami
A025B	Pepperoni/paprika-type sausage (unspecified)	Pepperoni/paprika-type sausage (unspecified)	Pepperoni/paprika-type sausage	Pepperoni/paprika-type sausage (unspecified)
A025C	Chorizo and similar	Chorizo and similar	Chorizo and similar	Chorizo and similar
A025D	Linguica, sausage	Linguica, sausage	Linguica, sausage	Linguica, sausage
A025E	Snack sausages (like Cabanos and landjäger)	Snack sausages (like Cabanos and landjäger)	Snack sausages (like Cabanos and landjäger)	Snack sausages (like Cabanos and landjäger)
A025F	Ripened kolbasz	Ripened kolbasz	Ripened kolbasz	Ripened kolbasz
A025H	Matured charcuterie products for cooking	Matured charcuterie products for cooking	Matured charcuterie products for cooking	Matured charcuterie products for cooking
A025J	Cooked sausages (generic)	Cooked sausages (generic)	Cooked sausages (generic)	Cooked sausages (generic)
A025K	Spreadable cooked sausages (unspecified)	Spreadable cooked sausages (unspecified)	Spreadable cooked sausages (unspecified)	Spreadable cooked sausages (unspecified)
A025L	Liver-type sausage (unspecified)	Liver-type sausage (unspecified)	Liver-type sausage	Liver-type sausage (unspecified)
A025M	Braunschweiger	Braunschweiger	Braunschweiger	Braunschweiger
A025N	Sliceable or firm cooked sausages (unspecified)	Sliceable or firm cooked sausages (unspecified)	Sliceable or firm cooked sausages (unspecified)	Sliceable or firm cooked sausages (unspecified)
A025P	Polish-type cooked sausage	Polish-type cooked sausage	Polish-type cooked sausage	Polish-type cooked sausage
A025Q	Mortadella-type sausage	Mortadella-type sausage	Mortadella-type sausage	Mortadella-type sausage
A025R	Bologna-type sausage	Bologna-type sausage	Bologna-type sausage	Bologna-type sausage
A025S	Blood-type sausage	Blood-type sausage	Blood-type sausage	Blood-type sausage
A025T	Miscellaneous cooked sausages (unspecified)	Miscellaneous cooked sausages (unspecified)	Miscellaneous cooked sausages (unspecified)	Miscellaneous cooked sausages (unspecified)
A025V	Cooked salami	Cooked salami	Cooked salami	Cooked salami
A025Y	Blood and tongue sausage	Blood and tongue sausage	Blood and tongue sausage	Blood and tongue sausage
A025Z	Head cheese	Head cheese	Head cheese	Head cheese
A026A	Pre-cooked sausages to be cooked before consumption (unspecified)	Pre-cooked sausages to be cooked before consumption (unspecified)	Pre-cooked sausages to be cooked before consumption (unspecified)	Pre-cooked sausages to be cooked before consumption (unspecified)
A026B	Frankfurt-type sausage (unspecified)	Frankfurt-type sausage (unspecified)	Frankfurt-type sausage (unspecified)	Frankfurt-type sausage (unspecified)
A026C	Frankfurter sausage	Frankfurter sausage	Frankfurter sausage	Frankfurter sausage
A026D	Wiener sausage	Wiener sausage	Wiener sausage	Wiener sausage
A026F	Beerwurst	Beerwurst	Beerwurst	Beerwurst
A026P	Pate, goose liver	Pate, goose liver	Pate, goose liver	Pate, goose liver
A026Q	Pate, chicken liver	Pate, chicken liver	Pate, chicken liver	Pate, chicken liver
A026R	Pate, pork liver	Pate, pork liver	Pate, pork liver	Pate, pork liver
A02KC	Fish fingers, breaded		Fish fingers, breaded	Fish fingers, breaded

Factor f3 – role in reducing double-counting

Comparing input data (Annexes) for the 7 exemplified food processes/FEIM models show sums of f3* above 1 for many foods (FoodEx categories), meaning enzyme exposure from these foods are counted more than once

Sum of f3 in the 7 exemplified FEIM models:

- | | |
|---------------------------|-------------|
| Total sum of f3 > 1: | 214 Foods |
| • Sum f3 between 1 and 2: | • 153 Foods |
| • Sum f3 above 2: | • 61 Foods |

The 7 exemplified food processes/FEIM models:

Food process
Production of flavouring preparation from dairy products
Production of whey concentrates and whey protein isolates
Production of whey protein hydrolysates
Production of modified meat and fish
Production of protein hydrolysates from meat and fish protein isolates
Production of protein hydrolysates from plants
Processing of yeast and yeast products

Using an appropriate factor f3 may help reduce double-counting

Conclusion and way forward

Double-counting of dietary exposure may occur when an enzyme is used in several food processes for the same activity, because the same foods are listed in several FEIM models

Double-counting of dietary exposure

- leads to overestimated dietary exposure, and
- may potentially lead to MoE issues and inconclusive opinions

How will double-counting of dietary exposure be avoided for an enzyme used in several food processes with FEIM models listing the same foods/FoodEx categories?



THANK YOU!