PROCESS-SPECIFIC TECHNICAL FACTORS USED IN THE EXPOSURE ESTIMATION OF FOOD ENZYMES

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DIETARY EXPOSURE ESTIMATION IN THEORY

Exposure = concentration of chemical x consumption data

Enzyme dosage

Food consumption

DIETARY EXPOSURE ESTIMATION IN PRACTICE

Enzyme dosage

Technical factors

Food groups (different beer type)

Technical factors

Food consumption

The amount of enzyme / kg of barley

The amount of beer consumed / person

TRACING ENZYMES FROM FERMENTER TO FOODS

Enzymes can be applied at different steps of a food manufacturing process

EFSA self-task in 2017 to harness the challenge by collating technical data with the aim to develop

- Excel-based FEIM calculators
  - single food manufacturing process
- FEIM-web tool
  - multiple food manufacturing processes.

TECHNICAL DATA

FoodEx hierarchical code	FoodEx matrix description	FoodEx hierarchical level	f1 (converting molasses to sugar beet or to sugar cane)	f2 (average fraction of molasses in respective FoodEx category)	f3 (Percentage of FoodEx category containing molasses)
A.01.06.001	Cereal flakes	3	40	0.04	0.03
A.01.06.002	Muesli	3	40	0.001	0.03
A.01.06.003	Cereal bars	3	40	0.001	0.01
A.01.07.001.020	Fruit cake	4	40	0.01	0.25
A.01.07.001.024	Gingerbread	4	40	0.1	1.00
A.01.07.001.044	Lebkuchen	4	40	0.1	1.00
A.01.07.002.008	Speculaas	4	40	0.1	1.00
A.10.04.001	Candies, with sugar	3	40	0.001	0.01
A.10.04.011	Liquorice candies	3	40	0.001	0.13

Example

f1 - Conversion factor converting the food or ingredient consumed into the raw material to which food enzymes are directly added

f2 - Ingredient fraction reflecting the amount of ingredient in the food as consumed in which the food enzyme is present

f3 - Fraction of food items containing the ingredients of interest within the total food category

- f3 ≠ market share independent of the enzyme manufacturer/applicants
- The frequency appearing on a food label

FOOD GROUPS

- Specific to a food manufacturing process
- Coded by FoodEx classification system (FoodEx1 → FoodEx2)
- Selection is influenced by:
  - Descriptor of the food manufacturing processes
  - Raw material to which the enzyme is added
  - Ingredient search on GNPD Database from Mintel
- Subject to feedback mechanism via open call from stakeholders and prior to finalisation for dossier evaluation and calculator

F1

A technical conversion factor applied to a food or food ingredient in order to bring it on par with the raw material to which the food enzyme is added. For example, beer is converted to barley grain, to which the food enzyme is added during the brewing process.

Sources

- FAO Technical Conversion Factors for Agricultural Commodities
- Literature study
- Feedbacks from the calls-for-data

F2

F2 represents the ingredient fraction of interest in a food included in the exposure assessment.

- For example, bread contains 70% flour, therefore consumption of bread is corrected by a factor of 0.7 to reflect the flour component only.

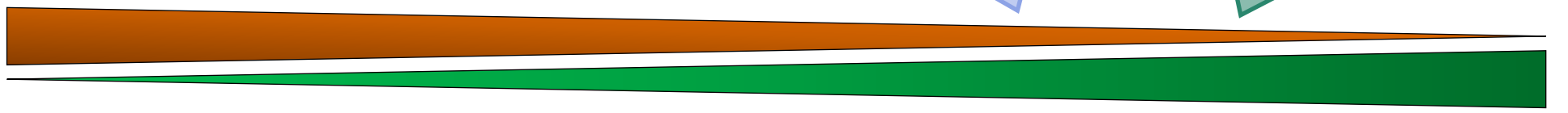
Sources

- EFSA Raw Primary Commodity (RPC) Model
- Mintel's Global New Products Database
- Publicly available recipe information
- Feedbacks from the calls-for-data

F1 AND F2

To estimate exposure to a food enzyme used in the "Production of baked products" both enzyme use level and food intake are expressed on the basis of flour

FoodEx1 hierarchical code	Food groups	FoodEx1 hierarchical level	f1 g raw our)	Explanation of the concerned ingredient	f2 raction of pective tegory)	f3 age of egory flour)
A.01.04	Bread and rolls (unspecified)	4	1.0	flour	0.70	1
A.01.04.001	Wheat bread and rolls	3	1.0	flour	0.70	1
A.01.04.002	Rye bread and rolls	3	1.0	flour	0.70	1
A.01.04.003	Mixed wheat and rye bread and rolls	3	1.0	flour	0.70	1



Raw material → Ingredient → Final food

Enzyme use level
[Applicant's dossier]

Food consumption data
[EFSA Comprehensive Database]

TOS per final food x consumption of final food

TOS per ingredient x consumption of ingredient

TOS per raw material x consumption of raw material

F3

- F3 ≠1, in those cases when only a certain percentage of food products within a larger food category are likely to contain the enzyme.
- It represents the fraction of food items containing the ingredient of interest (as declared on the product label) within the total food category searched.

Sources

- Mintel's Global New Products Database
- Feedbacks from the calls-for-data

For example, only a certain fraction of biscuits within the overall category of "biscuits with cream filling" are likely to contain coffee.

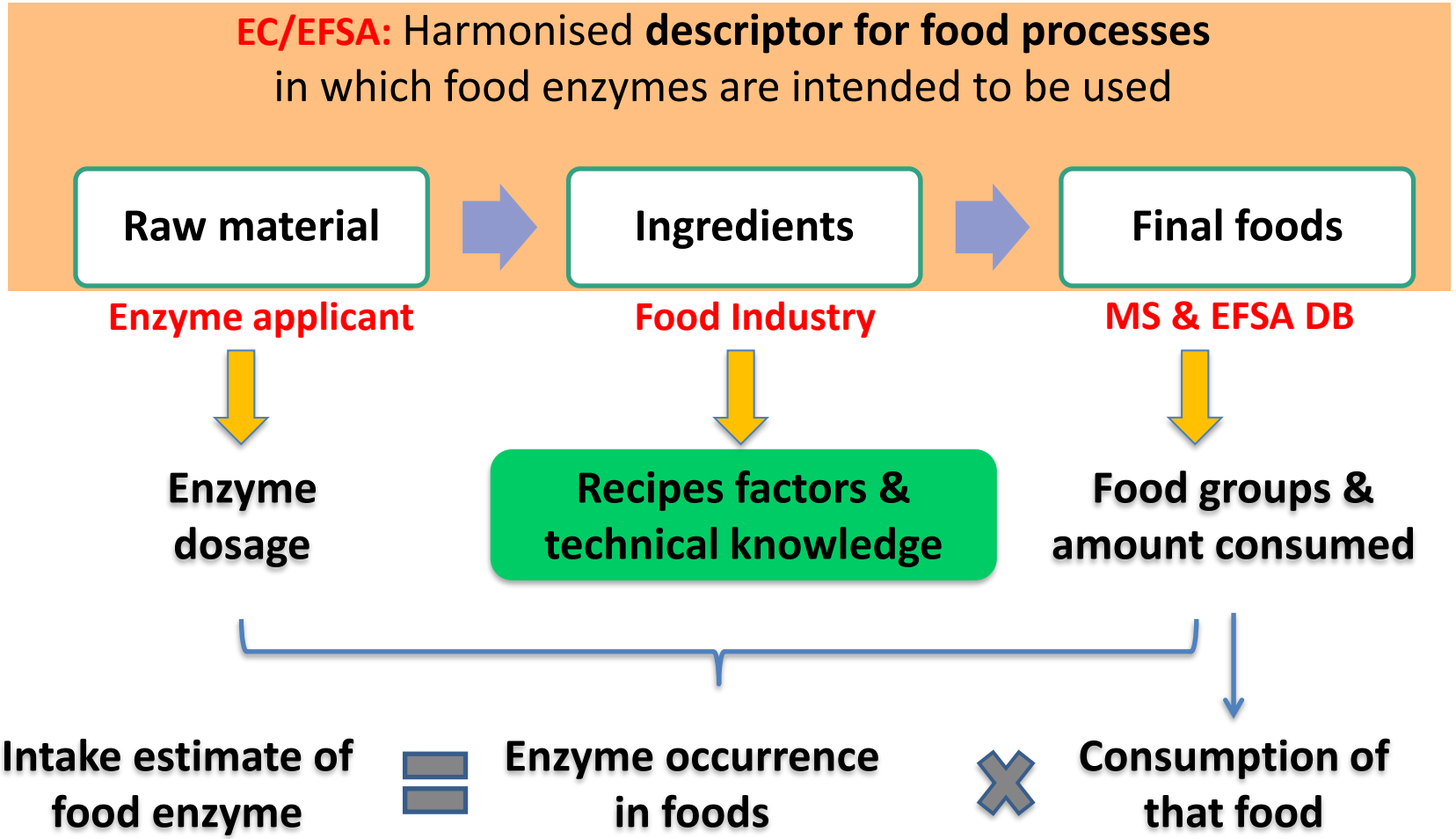
$$\text{Factor f3} = \frac{\text{the number of biscuits declaring coffee as ingredient}}{\text{the total number of biscuits listed in the food category}}$$

CALLS-FOR-DATA TO COLLATE TECHNICAL DATA

Prepare

Open call

Finalize & Use



EXAMPLES OF STAKEHOLDER CONTRIBUTION DURING CALLS-FOR-DATA

Food enzyme-TOS removal

- Distillation, repeated washing, etc.

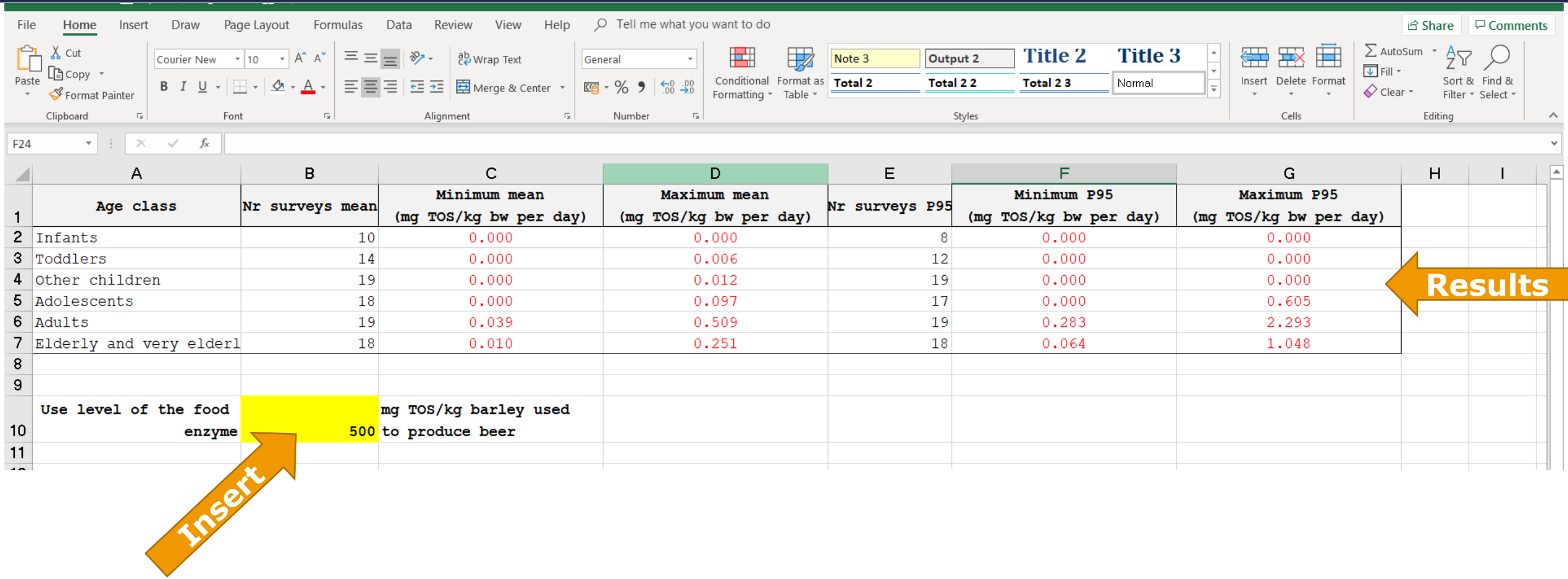
Food groups exclusion

- Milk cannot be flavored with dairy flavor.
- Lactose-reduced whey or milk are not used in the infant formulae and follow-on formulae.
- Yeast cell walls can also be used in food applications, but not only in animal feed.

Technical factors

- X amount of sugar beets can derive Y amount of molasses (f1).
- Average inclusion rates of food flavor in different foods (f2).
- Asparaginases are one of several mitigation measures for acrylamide (f3).

FEIM CALCULATOR



	A	B	C	D	E	F	G	H	I
1	Age class	Nr surveys mean	Minimum mean (mg TOS/kg bw per day)	Maximum mean (mg TOS/kg bw per day)	Nr surveys P95	Minimum P95 (mg TOS/kg bw per day)	Maximum P95 (mg TOS/kg bw per day)		
2	Infants	10	0.000	0.000	8	0.000	0.000		
3	Toddlers	14	0.000	0.006	12	0.000	0.000		
4	Other children	19	0.000	0.012	19	0.000	0.000		
5	Adolescents	18	0.000	0.097	17	0.000	0.605		
6	Adults	19	0.039	0.509	19	0.283	2.293		
7	Elderly and very elderl	18	0.010	0.251	18	0.064	1.048		
8									
9									
10	Use level of the food enzyme	500	mg TOS/kg barley used to produce beer						
11									

Results

Insert

FEIM calculators can be downloaded from *https://zenodo.org/*

June 28, 2022 (v3) Software Open Access

February 20, 2023 (v1) Software Open Access

CALLS-FOR-DATA TO COLLATE TECHNICAL DATA

2016

18 calls

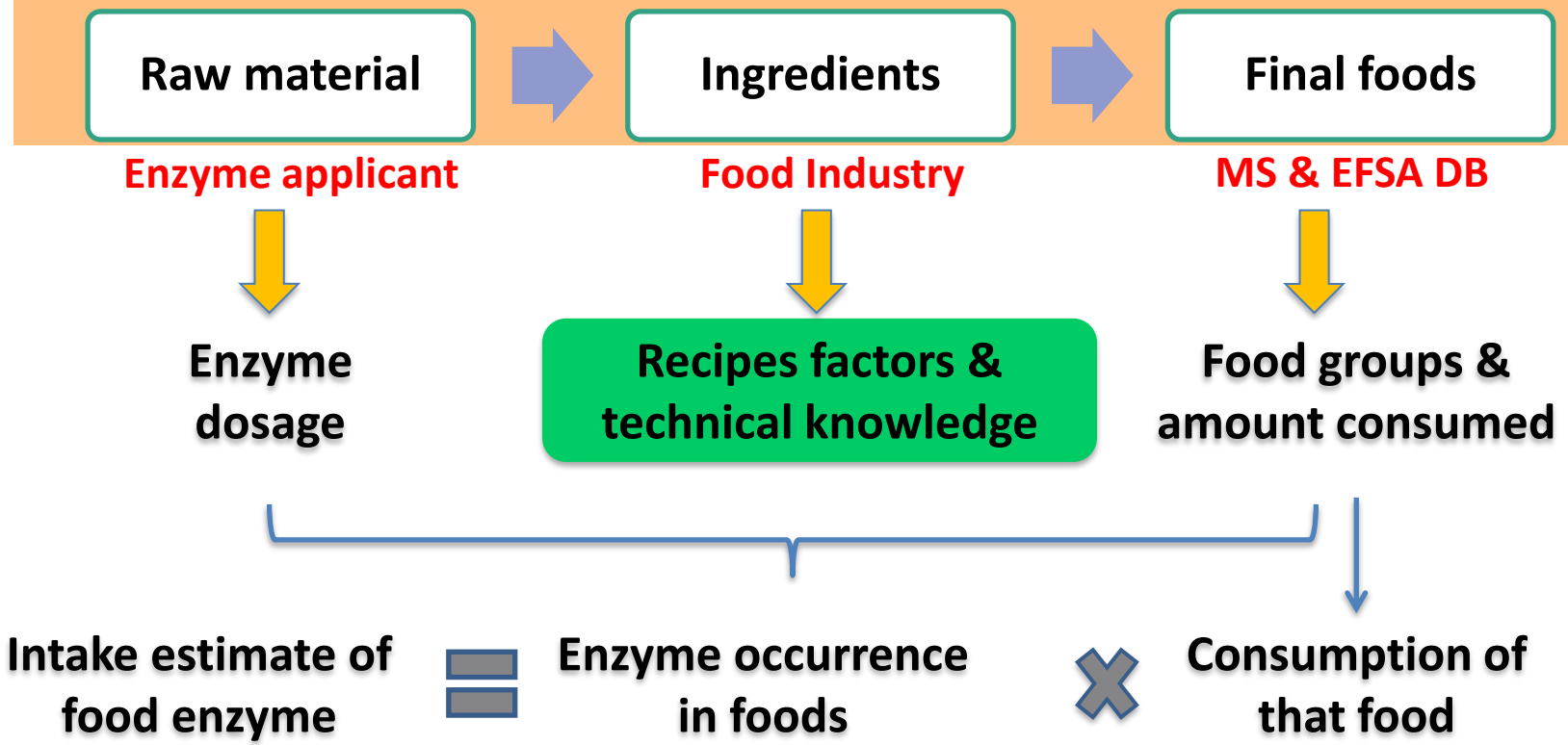
Is the food enzyme TOS removed?

Where residual TOS remains, feedback to technical data.

41 calls

2022

EC/EFSA: Harmonised **descriptor for food processes** in which food enzymes are intended to be used



TECHNICAL FACTORS IN THE 2023 EDITION OF THE STATEMENT

- Technical factors identified for all the food manufacturing processes in which the FE-TOS is not removed.
- Systematically checked to avoid double counting or over-estimation
  - Compared to the previous editions, exclusions of some FoodEx categories have been made in some food manufacturing processes.
  - Reduction of more or more technical factors have been made for some food groups.
- Food groups coded in the FoodEx1 are translated into the FoodEx2 system, so are their technical factors.

OUTCOME OF THE SYSTEMATIC CHECK

MAXIMUM P95 (mg TOS/kg bw per day)

Use level: 100 mg TOS/ Kg flour

Baking processes

Year / Age class	2018	2020	2022	2023
Infants	1.19	1.19	1.19	0.67
Toddlers	1.02	1.02	1.02	0.95
Other children	1.09	1.09	1.09	1.03
Adolescents	0.75	0.75	0.75	0.58
Adults	0.45	0.42	0.45	0.43
Elderly and very elderly	0.36	0.36	0.37	0.33

THANK YOU VERY MUCH FOR YOUR ATTENTION

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