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# **Requirements on food consumption studies with respect to risk assessment**

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# **Overall goal of food consumption studies with respect to risk assessment**

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**The reliable measurement of the habitual food intake of a defined group of consumers to calculate the statistical parameters (eg. mean, maximum intake) of a specific food component (eg. essential or non-essential nutrient, contaminant) from a specific food or food group or from the total diet.**

# The ideal study group

(from the point of an accurate assessment)

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**All members of the study sample participate, are compliant, can be widely controlled in their daily activities, eat and drink only a small variety of highly standardized foods with fixed portion-sizes.**

**Breakfast: toast+butter+marmelade+tea**

**Lunch: french fries+ketchup+curry sausage**

**Dinner: big-mac+cola  
beer+potato chips**

→ Arrested persons, with communal feeding and no choices for individual food selection and portion size.

# General dietary recommendations

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- **Eat a large variety of foods from plant and animal origin.**
- **Prefer fresh fruits and vegetables.**
- **Prefer regional and seasonal foods.**
- **There are almost 100.000 food items in the market.**
- **These dietary recommendations cause a lot of problems in the reliable assessment of food intake.**
- **Assessment of food intake is one of the most difficult study objects.**

# **The ideal study group**

(from the point of risk assessment)

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**Consumers with large variation of different eating habits:**

- **different foods**
  - **different portion-sizes**
  - **including vulnerable groups** (eg. toddlers, elderly, pregnant women)
- **large range of intake levels** (including non-consumers, normal-consumers, heavy-consumers)  
**and large interindividual variation**

# General problems in nutrition surveys

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- **Need of free-living human volunteers.**
- Selection of an appropriate assessment tool for the recording of the consumed food-stuff.
- Food composition tables and other data sources.
- Computer programs for coding and processing of the recorded food items and for statistical analysis.
- Quality control on all levels of the study.
- Considerable resources (funding, trained staff, time-consuming).

# Need of free-living human volunteers

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- **Random samples of the population with a large variety of eating habits/food intake.**
- **Food consumption studies have to be conducted with all groups of interest** (men, women, different age groups, especially vulnerable groups).
- **An interpolation from one group to another** (eg. from food intake of adults to children) **by taking the body-weight into account is error-prone and not acceptable.**
- **The size of the study group is depending on the anticipated effect** (smaller effects need larger sample sizes; ~2,5/10.000).

# The burden of volunteers

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- **Being a volunteer means**
  - a considerable workload
  - spending much time for the recording
  - uncomfortable situations (eg. in restaurants)
  - highly motivated volunteers
  - considerable literacy
- **The burden reduces participation rate and increases drop-out rates in follow-up-studies or for repeated measurements.**
- **Nutrition and health surveys are susceptible to selection bias** (eg. people with lower education more often refuse to participate than people with higher education levels; health-conscious people show an above-average motivation and participation.)
- **Strategy to increase participation: attractive incentives** (eg. money, gifts, dietary analysis and counselling)

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# Selection of the assessment method

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**Dependent on:**

- **aims and the main question of the study**
- **target group:** individual, household-level population group, national level
- **required accuracy and completeness of the food intake**
- **costs and available resources**
- **time-period, for which nutritional informations are needed**

# Dietary assessment methods

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- **Prospective methods:** dietary records  
double portion technique
- **Retrospective methods:** food frequency questionnaires (FFQ)  
24-h recalls  
diet history (eg. DISHES<sup>®</sup>)

**All methods have their specific advantages and disadvantages!**

# What are the determinants for the selection of the assessment method?

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- **Is a more global characterisation of the food consumption sufficient** (eg. coffee-consumer: yes/no), **or are very detailed information of the specific food consumption needed** (eg. sort and style of coffee, average amount, way of preparation/brewing (Turkish or Norwegian or standard style)?)
- **Is a total dietary assessment required** (eg. recording of all consumed food items) **or is it sufficient to limit the assessment to specific food groups** (eg. only food with a specific food additive; only food from plant origin; example: ochratoxin: cereals, cereal-products, nuts and including all dishes containing cereals)?)
- **Is the actual and/or acute intake of the substance or the previous and/or chronic intake of interest** (eg. mean fruit and vegetable or red meat consumption during the past 20 years)?)

# Duration of the food recording in prospective studies

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**1-day food record:**

- intraindividual variation cannot be calculated
- flat and wide frequency distribution curves

**7 to 14-day food record:**

- intraindividual variation can be calculated
- the habitual food intake can be observed
- problems of underreporting/underreporting (= reactive tool)

**For risk assessment** → preference of repeated dietary records  
(eg. 2x3 days with a time-lag of several months)

# Confounding during recording

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- **Undereating/underreporting**
  - „unhealthy food“ (sweets, alcoholic beverages, fat-rich foods) are often underestimated,
  - foods consumed between meals are sometimes not remembered and not recorded,
  - complicated recipes/dishes are less consumed during the recording period.
- **Overeating/overreporting**
  - „healthy food“ are overestimated or eaten in larger amounts than usual.

# Where are we eating today?

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- at home
  - canteen/cafeteria
  - restaurant
  - take-away
  - fast-food-restaurant
  - gas station
  - car
- } weighed/estimated record
- } estimated record

→ Problem of imprecise portion sizes and improper description of the consumed food item.

# Increasing the accuracy of the portion size

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- **Correct estimation of the portion size is a main problem in dietary surveys**
- **Weighing of all food items**
  - results in a lower participation rate
  - may increase the reactivity of the tool
- **Recording of household-measures**  
(eg. cup, glass, spoon)
- **Using a picture-book with different portion sizes on a plate or in a cup** (eg. EPIC picture book)

# What are we eating today?

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- **Less than 30 % of energy come from unprocessed basic foods** (eg. fresh fruits, vegetables, nuts, cereals, raw meat).
  - **Pre-processed food composed of several components, but not ready-to-eat** (eg. instant soups, cake or bread mix, deep-frozen pizza, oven-frites).
  - **Ready-to eat food or convenience food composed of some or many components** (eg. pizza, yoghurt with fruits, cheeseburger, breakfast cereals, black forest cherry cake, brownies, gummi-bears, nutella).
- ➔ **An exact recording of all consumed food, including the way of preparation is required, followed by a dissection into the single components by the recipes.**  
(additional the recording of packing material might be necessary)

# Special problem: assessment of the exposure to microorganisms

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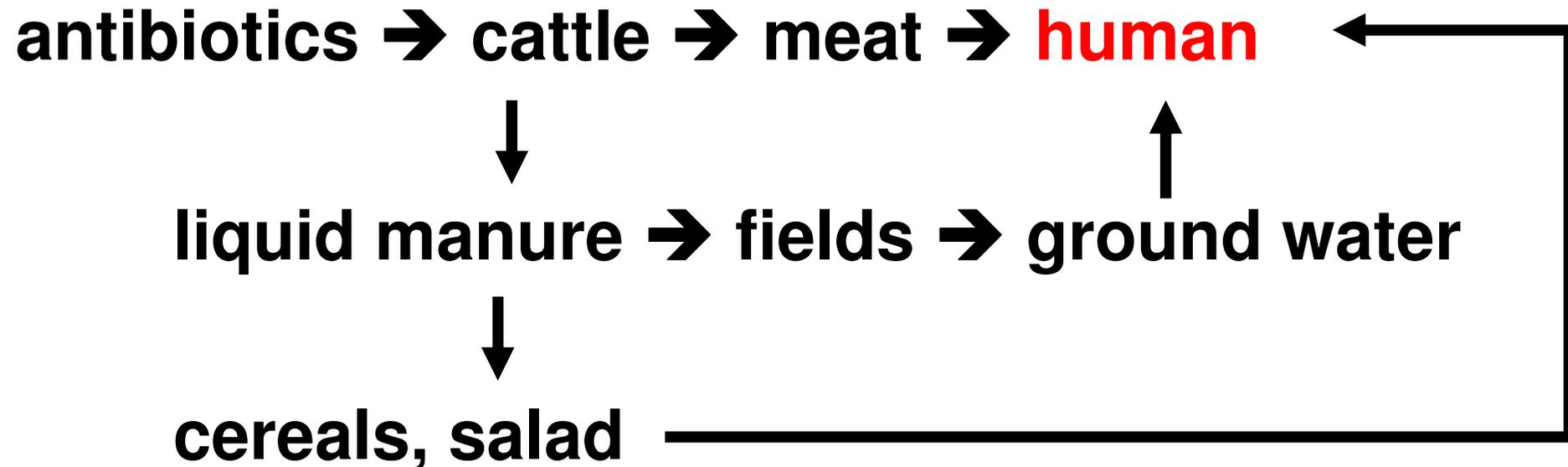
- **Which food can be the vectors?**
- **Is the frequency of exposure more important than the total amount?** (eg. 3 x 500 g chicken or 20 x 75 g chicken per month)
- **Characterisation of processing and heating**
- **Secondary infections**

**Example of listeriosis:** amount and frequency of raw milk and raw-milk-cheese

# Multiple entrance pathways of pharmaceuticals in environment and food

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Problem of antibiotics resistance of pathogen micro-organisms by low concentrations of antibiotics in different environmental compartments.

# General problems in nutrition surveys

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# Food composition tables

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- **Large differences in nutrient contents of food** (eg. vitamin C in different sorts of apples; pattern of fatty acids in margarines)
- **Food composition tables contain lots of missing values.**
- **Food composition tables mainly focus on rough food or processed food, but rarely on complex dishes.**
  - **a dissection of complex foods into their single components by the recipes is required prior to the aggregation step**
  - Use of EFSA European Food Consumption Concise Database
  - **Special tables with „unusual“ food containing substances are needed.**

# Problem of *user* and *non-user*

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- **Processed and composite foods demand a break-up of the recipes in all single components. The result is, that in many people very small amounts of a specific food can be observed.**
- **This is a significant problem for people with allergic reactions and for scientists working on risk assessment (eg. when calculating the mean intake of a contaminant).**
- ➔ **In statistical analysis: extreme skewed frequency distribution curves and very small mean values.**
- ➔ **Definition of „non-user“ („problem of a half cherry“).**

# Problem of *heavy-user*

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- **Is a calculated high intake of a specific food item the result of a recording or typing error?**
- **Is a calculated high intake feasible?**
- **..**

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# Data processing and data quality

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- **Computer programs for coding of recorded data**
  - should be comfortable
  - reduce input data error
  - should be flexible and allow an extension of the food list
  - should include a recipe list
- **Training of coding staff**
- **Intensive quality control**
- **Checking the completeness and plausibility of recorded data ...**

# Requirements on food consumption studies with respect to risk assessment

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- **(Random) sample of a defined population group**
- **Detailed, reliable data on the habitual food intake**
- **Standardized computerized food-database**
- **Recipes of all consumed meals, dishes, convenience products**
- **Coding program**
- **Quality control program**
- **Aggregation step**
- **Combination with ingredient data**
- **Information on possible bias and other sources of error**

# The VELS-Study

(Nutrition survey in babies and toddlers for purposes of risk assessment)

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- **816 children** (no-breastfeeding)  
**age: 6 months to 5 years.**
- **Multi-center study, 10 sample points in all German regions.**
- **2x3-day food records, with the repeated measurement after 3-6 months.**
- **Recording in a special protocol-book was done by the mothers.**
- **Exact assessment by weighing-records.**
- **Also recording of preparation method, time of consumption ...**
- **Supervision of mothers and coding by trained staff.**
- **Development of a data-base with recipes.**
- **Dissection of recipes in single components.**
- **Aggregation of food according to the RHMV-food list.**



**Thank you!**