
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

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)

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

- 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.
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- 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)

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

- 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

- **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

- **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

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

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

All methods have their specific advantages and disadvantages!

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

- **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

- 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 undereating/
underreporting (= reactive tool)

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

Confounding during recording

- **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?

- 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

- **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?

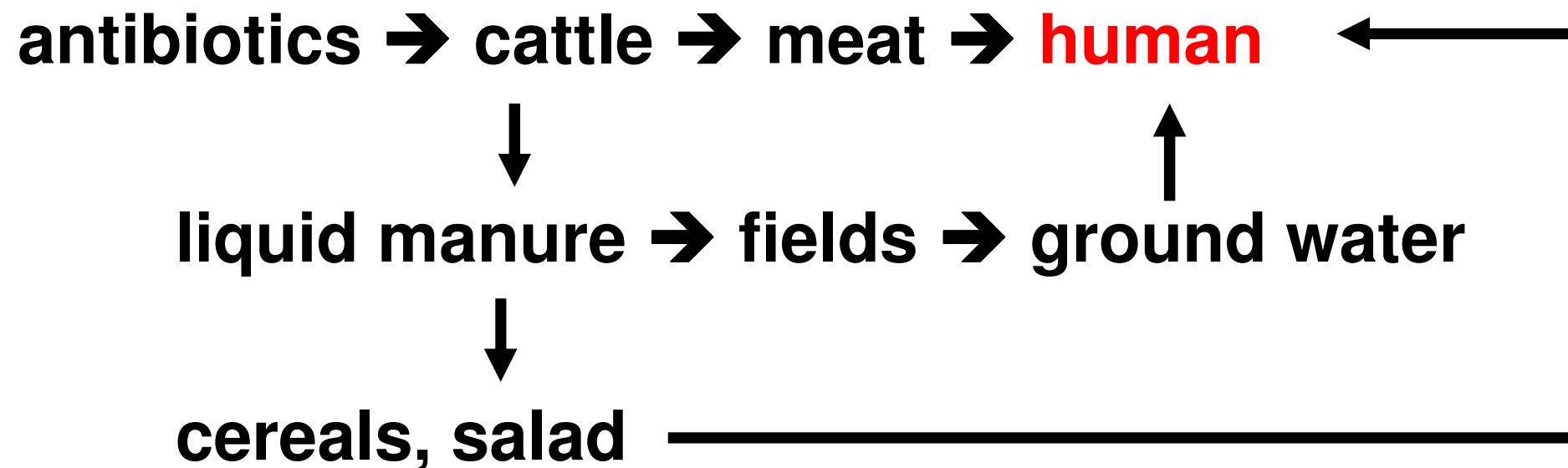
- **Less than 30 % of energy come from unprocessed basic foods** (eg. fresh fruits, vegetables, nuts, cereals, raw meat).
 - **Pre-processed food composed of several components, but not ready-to-eat** (eg. instant soups, cake or bread mix, deep-frozen pizza, oven-frites).
 - **Ready-to eat food or convenience 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

- 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



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

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Food composition tables

- **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*

- 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*

- 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

- **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

- (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)

- **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!