Foundations of the Development of a Food Monitoring Program

Day 2 – 27 February, 2023

11:00 – 12:00

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Definition

❑ Monitoring is defined as "a system of repeated observation, measurement and evaluation for a defined purpose, carried out on samples representative of individual foods or the diet in a country, or a given area within a country" (FAO/WHO).

❑ Survey = one time thing

❑ If Survey indicates a Health risk, then Monitoring is needed

❑ If control measures have been introduced, then Monitoring is needed.

def·i·ni·tion

/ defə|niSH(ə)n /

noun: a statement of the exact meaning of a word.

Differences between monitoring and surveillance

❑The ultimate objectives of both food surveillance and food monitoring are to protect the consumer from acute and chronic intoxications and food-borne infections, to improve the management of food resources and prevent losses in food supplies.

❑Food monitoring is a more long-term activity designed to provide baseline data and to show time-trends in food contamination.

❑Food surveillance activities are generally designed with the more immediate objective of preventing food which is unfit for human consumption reaching the consumer.

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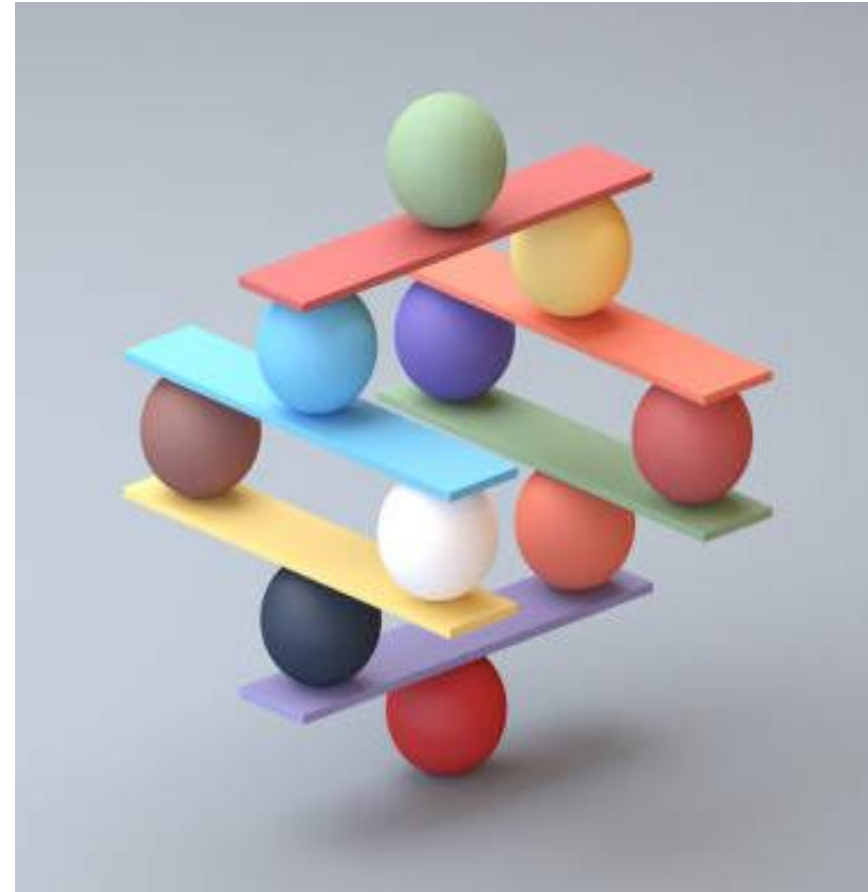
Why Food Monitoring?

Monitoring may be carried out for a variety of purposes:

❑ To establish a baseline and determine changes in the levels of a contaminant in food with time

  ▪ Provides a means of detecting increasing levels of contaminants in food before they become so high they pose a direct threat to human health when ingested.

  ▪ This is especially important when the contaminant does not produce ill-health soon after ingestion of the contaminated food but first after an interval of several months or even years.

  ▪ Important if the plant or animal (food) analysed can concentrate or accumulate contaminants from the environment.

❑ To give an indication of the effectiveness of measures introduced to reduce food contamination.

❑ To check that the levels of contaminants in food do not exceed established standards or guidelines, i.e. regulatory or compliance purposes.

  ▪ In this case "monitoring" = "surveillance"

- Country without a system for the monitoring and control of imports for contaminants will find it difficult to prevent itself being used as a dumping ground for substandard food rejected by other countries.

- A country without a system to monitor exported products runs the risk of having it rejected and suffering economic losses.

- A monitoring system increases confidence in the quality of the food a country exports and is likely to facilitate international trade and yield better economic returns for the exporting country.

Monitoring :

❑For identification of potential food safety issues.

❑Can show how the effect of banning the use of a persistent pesticide

❑To assess the impact of the introduction of new substances or practices in agriculture, food processing, food handling, etc. on food contaminant levels

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❑Major policy decision:
- Who is in charge ?
  - Ministry (health, agriculture and fisheries, environmental protection, trade, industry, economy, etc…)
- Planning and coordination

❑Establishment of a Working group to coordinate all monitoring activities
- By contaminant group
  - heavy metals, pesticides, etc..
- Or by food commodities
  - Fishes, nuts, etc…

Planning/Group Members

Knowledge needed on:

- The food contaminant and it potential use (ex: pesticides or veterinary drugs) in agriculture, horticulture, silviculture;

- The targeted food commodity (inter alia food chains, mobility), and its processing and distribution;

- Environmental contamination (including water, soil, wild-life, etc.) by the food contaminant and breakdown products thereof, which may lead to environmental contamination;

- Sampling procedures appropriate to the foods to be studied;

- Methods used and facilities available for analysing a specific food contaminant in various foods;

- Consumption data (preferably including data on both average consumption and individual intake) and the economic importance of various food commodities;

- Toxicology of the food contaminant;

Planning/Sampling

Information needed on:

❑ Data from similar surveys or monitoring projects already in operation

❑ Epidemiological data on actual or potential health problems related to contaminated food.

❑ Information on food production and processing, food trade, marketing channels, etc. including any information on rejection of food presented for import or export.

❑ Information from nutrition surveys and food consumption surveys, especially any indicating the existence of **vulnerable groups**.

❑ Information on the use of pesticides in agriculture, horticulture, silviculture (forestry), vector eradication programmes, etc. and the use of drugs in animal husbandry.

❑ Information on the release of potential food contaminants into the environment or on the levels of contaminants found by monitoring water, soil, air, etc.

❑ Information on the resources available to carry out the work.

❑ Information from research programmes showing the passage of contaminants through food chains.

❑Estimation of daily intake of lead via food:

- ▪ Is it a threat or not?
- ▪ Is there a trend that should be a matter of concern?
- ▪ Is it an issue in certain geographical area or food commodities?

❑**Monitoring of Aflatoxins in nuts** in a producer country:

- ▪ No problem for exportation
- ▪ Identification of areas where control measures should be improved
- ▪ Protection of consumers' health

Planning/Scope

The following factors are of importance when deciding priorities:

❑The **potential risk** to human health posed by the contaminant.

❑The **frequency** with which a food-contaminant is implicated in intoxications.

❑The **feasibility** of measuring the level of the contaminant in a reliable manner in an adequate number of samples.

❑The importance of the food in the total diet; **staple foods deserve special attention**.

❑The **economic** importance of the food concerned and the importance the importing/exporting country attaches to contaminant monitoring.

The following factors are of importance when deciding priorities.

☐ The **persistence, ubiquity and abundance** of the agent in the environment, its resistance to degradation, the possible conversion to more toxic substances and accumulation in the food chain.

☐ The **amount of the pollutant** being discharged into the air, rivers, coastal waters, etc. by industry and/or from centres of population and the levels of contaminants found in environmental components other than food.

☐ The **nature and amounts** of pesticides and other chemicals used in agriculture, horticulture and forestry, and of veterinary drugs used in animal husbandry.

☐ The **hygienic conditions** prevailing in connexion with the production, packaging, transport, distribution, storage and preparation of food.
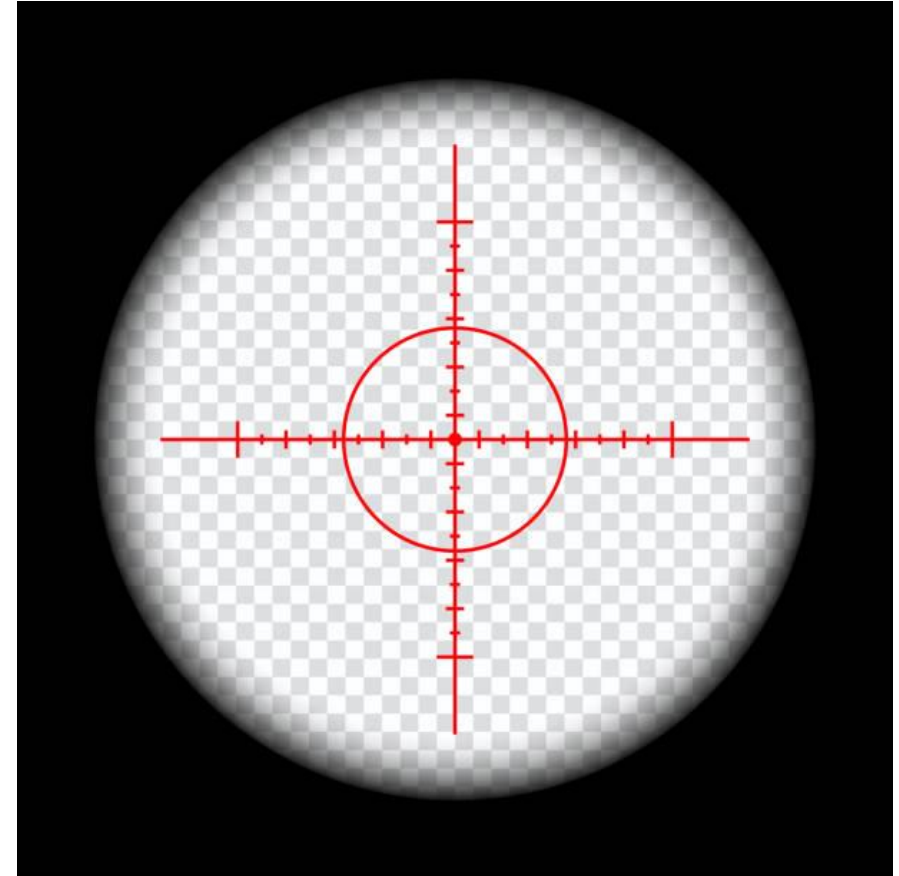
Planning/Scope (cont'd)

❑ Pilot study:

- Resolution of practical problems
- Possibility to upgrade for a large monitoring project

❑ Evaluation of the monitoring project

- Data on the resources employed
- Evaluation of the benefits
  o In financial terms (if possible)
  o Reduction of specific foodborne disease

❑ What to sample?

❑ At which point in the production chain?
- Close to the harvesting/slaughter/production
- At point of entries and at the wholesale level
- Sampling at the retail level

❑ Sampling "as eaten"

Implementation/Sampling

❑Different approaches to sampling depending on potential hazard

▪ Examination of each individual food unit

▪ Representative samples taken from each lot

▪ Representative samples taken from lots chosen according to a predetermined plan or at random

❑Obtaining a representative sample

▪ Homogeneity

▪ Methods of eliminating bias

❑Sampling in the field

▪ Done par experts

▪ Records needed

▪ Transport conditions are important

❑Establishment of "Food Sample Banks" for food contamination monitoring purposes

Implementation/Sample prep

❑ Preparing sample units from field samples

- Methods depends on the objectives of the programme

- Standardized methods

- Records!

❑ Sample units for chemical analysis

- Regulatory (compliance) programmes

  o Preparation should be stipulated by the regulatory framework

- Projects aimed at showing time-trends in contaminant levels in specific commodities

- Projects aimed at estimating the intake of a contaminant via food

❑The case of total diet study

- Based on household food consumption surveys
- Based on local preparation habits
- Based on different groups consumptions

❑It is country specific

❑Need large resources and planning

Implementation/Method of analysis

❑Most important part of any monitoring programme

▪ Adequate facilities

▪ Well-trained personnel

▪ Adequate supervision

❑There are many guidelines

▪ Guidelines on Performance Criteria for Methods of Analysis for the Determination of Pesticide Residues in Food and Feed - CXG 90-2017)

▪ Methods of sampling and analysis for the control of levels of certain contaminants in foodstuffs (European Union)

❑Methods must be validated and fit for purpose for both the food contaminant and the type of food.

❑Preference is the development of multi-molecules methods vs single methods.

❑Single residue methods are always possible provided that the cost and effort can be justified.

❑A national surveillance program should be put in place to verify the robustness of the whole process

❑Care must be taken when comparing results with other countries

Implementation/Quality control

❑To achieve precise and accurate results

❑If possible, use the same method in different laboratories

❑Provide instruction for the personnel

❑Organization of inter-laboratory collaborative study

❑Restricting analysis to (approved laboratories) wich have adequate ressources

❑Periodic inspection of approved laboratories

❑Identification of the sample

- Standardized form or Basic information: nature and origin of the sample, date and place of sampling, name of the supplier, etc…

❑Analysis performed

- Sample preparation
- The analytical method in details
- Date and place of analysis
- Name of the analyst

❑Levels of contaminants

- Units

❑ Application will depend on the food and the nature of the contaminant

❑ Importance of the statistical distribution of the results

❑ In general:

- Number of samples analysed, median, average, 90th percentile
- Standard deviation, variance, standard error for normal distributions
- Detection limit!
- Samples below LOD should be considered at half of LOD (not zero).
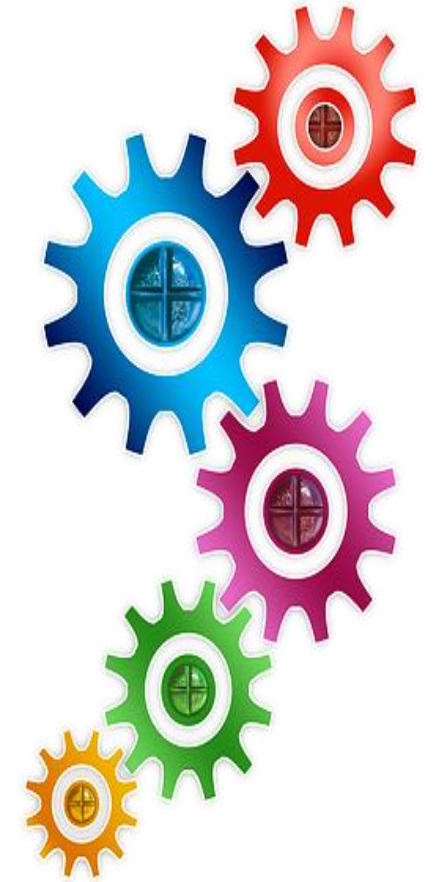
Data handling / presentation / classification

❑Two main functions:

- To collect, appraise, process, store and retrieve data generated and present it to the user in an appropriate manner

- To facilitate the management of the programme

❑Manual handling then computer based systems when there are too much data

❑Data should be stored at one place (per monitoring projects)

❑Data calling for immediate action

- Screening of all results at the national center and any alarming levels of contaminant recognized and appropriate action taken

- Screening of results at the laboratory

❑Other data

Collection and handling of data on sampling and analysis

❑Sampling data form filled by the person taking the sample

❑Analysis data form filled by the analyst

❑Validation that sampling and analysis reach the agreed criteria

❑"suspect" samples should not be combined with representative samples

❑Double-check results coming from different laboratories

❑Only data which satisfy the agreed criteria are then entered into the central data file(s).

Data outputs

- Standard summaries
  - Basic descriptive statistics
  - Summarization by sampling, location or laboratory
  - To follow progress of the programme
- Special tailored compilations of data
  - Association with other information
    - Data on the production or consumption of the food
    - Levels of contaminants in other media
    - Climatic conditions
- Data mining?
- Storage and retrieval
  - At the center that handle the project (+ back up)
- Publication
  - Scientific publication
  - Official reports
  - Good way to increase consumers's trust
- Progress reporting to improve project management

Use of Data

- Preventing contaminated food from reaching the consumer
  - Presence of contaminants at a high level
  - Action taken before sales (imports, etc..)
  - System of food recall for products already on the tablets
  - Alert system for consumers and for foreign countries
- Estimating the intake of contaminants via food
  - For long term risks
  - Need of data form other sources of ingestion
  - For the whole population and subgroups
- Based on (total diet study results or individual food results) x Food consumption
- Do not forget other sources of intake
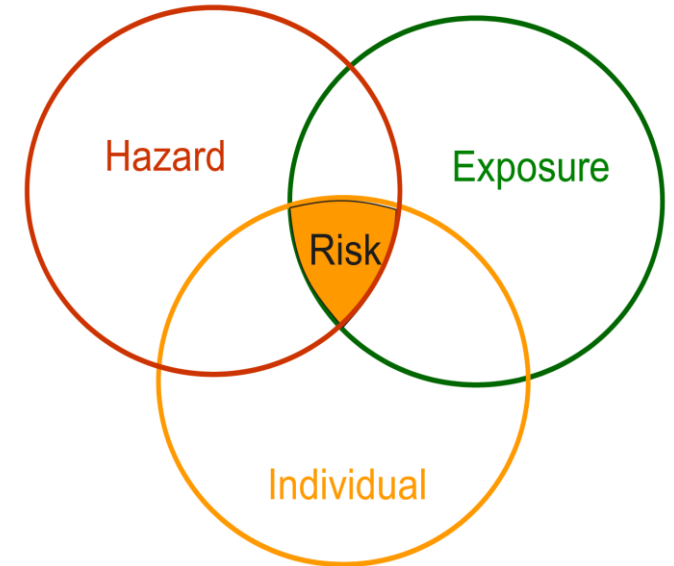
Use of Data/Need for and effect of measures

❑ Control of pesticide use
- Indication of potential bad agricultural practice → observation of corrective measures with monitoring

❑ Control of the use of veterinary drugs in animal husbandry
- Undesirable high levels → Restriction on access to veterinary drugs

❑ Chemical contamination during processing and handling
- Changement of processing techniques
- Improvements in packaging materials

❑ Environmental pollution
- If the source can be identified → Reduction or elimination
- Estimation of the threat to human health and economic consequences

Use of Data

- Help for the setup of a system of import control (surveillance)
  - For certain imported food and specific contaminant
  - For exporting countries without monitoring programme
- For export control
  - Help for bi or multilateral agreements
  - No duplication of control activities
  - Increase purchaser's confidence
- Introduction of new substances
  - New pesticides
  - New production techniques
- Localisation of sources of food contaminant
  - From geographically well-defined areas
    - E.g Identification of problematic factory
    - E.g Identification of distances for contamination via atmosphere

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❑Establishment of Maximum (Residue) Limits

❑Correlation with contaminant levels with human diseases

❑Identification of research problems
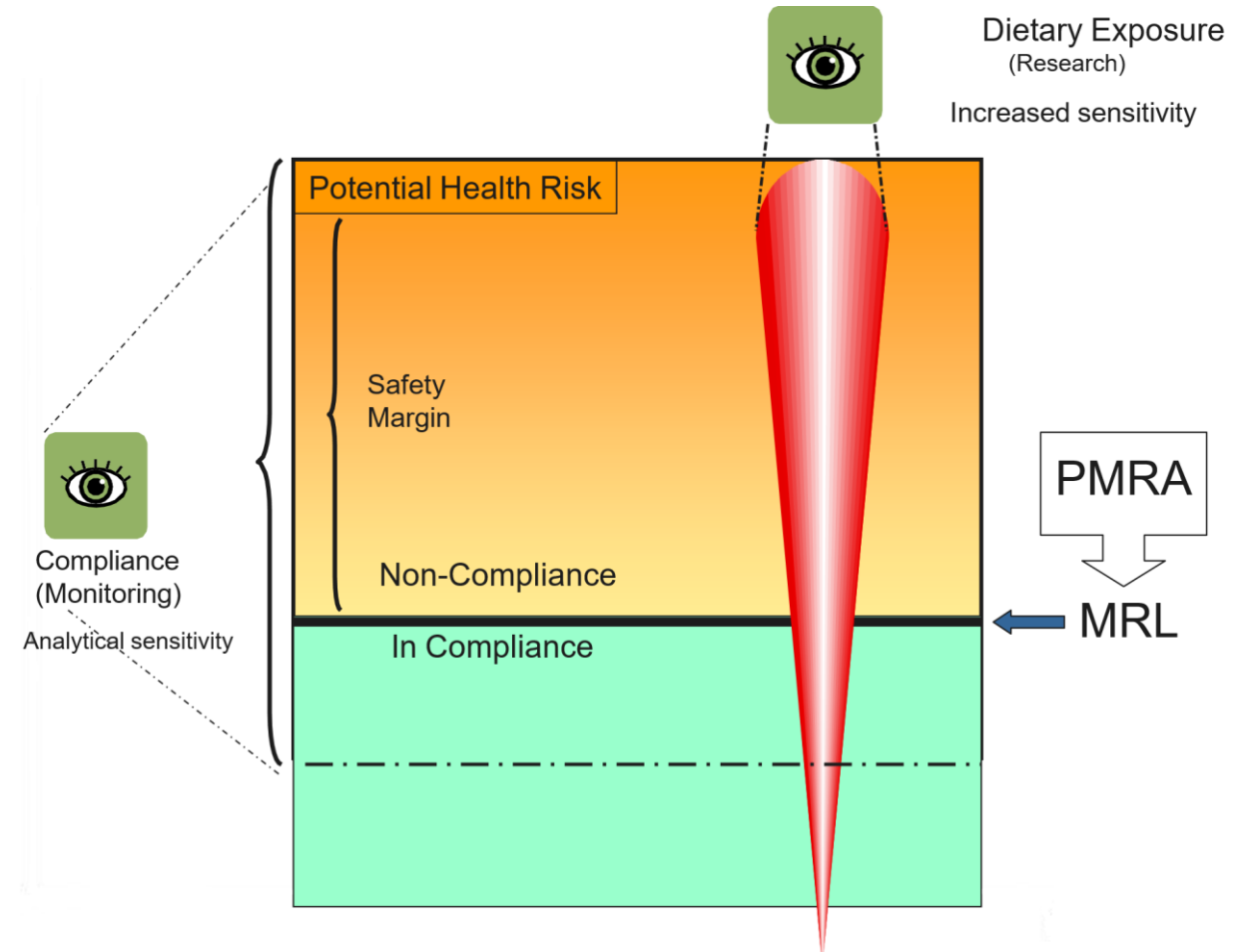
Conclusion

❑A lot of planning and preparation

❑Resources **needed and secured** before starting

❑Sampling is not trivial

❑Analysis is actually the part that people know the most about

❑The handling of data is key

- Storage of data
- Use of data
- What do to do with it
  - o Corrective measures
  - o Monitoring of new substances
  - o Identification of problems (environmental contamination)
  - o Import/Exports

❑Risk communication is also important

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