



Chapter 2

Food Additive Intake Assessment

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INTRODUCTION

- Both **international** organizations and **local** governments generally evaluate the safety of food additives.
- **The goal of local assessment is:**
 1. to take into account **local food supply**
 2. and **cultural differences** in dietary habits

that **may influence** the **intake of food additives**.

Food additive intake assessment **has three major goals**:

1. **Monitoring** the intake of chemicals and relating it to the acceptable daily intake (**ADI**) values
2. **Identifying consumer groups** that may be **at risk** for food additive intake close to or higher than the ADI values
3. Provide information for the **regulatory bodies** for **reassessing** the food **additive regulations** in case of high intake in all or some consumer groups

- **The major aim** of the intake assessment is to protect consumer **health** and to assist in developing **food additive regulations**.
- The **safety evaluation** of food additives is based on :
 1. the **assessment of toxicity** of the **chemicals** added to **food**.
 2. And determine the extent to which ADI values may be exceeded

- The **ADI value** is determined by the Joint FAO/WHO Expert Committee on Food Additives (**JECFA**).
- **ADI value:** is an estimate of the amount of food additives, expressed on a body weight basis, that can be ingested over a lifetime without appreciable health risk (WHO, 1987). It is measured in milligrams per kilogram of body weight.

How is the ADI for an additive determined?

- It is usually derived from long-term animal feeding studies.

First, the No Adverse Effect Level is determined, which is: the highest dose of an additive that can be fed to the most sensitive animal species on a daily basis with no toxic effects.

A large safety factor is then added or determined—usually by **dividing** the level in animals by **100** – to arrive at a safe level for humans.

For example, if the no effect level in animals is found to be 100mg/kg, then the human ADI would be set at 1mg/kg.

- The safety factor is built in partly to account for the:
 1. **differences** between animals and humans,
 2. and **also** to allow for the **variability** between different people, such as age and health.

- The ADI is **not a level of toxicity** – it is a level that has been **found to be safe**.
- Consuming more than this on **occasions** is unlikely to cause health problems, **as long as the average daily intake is below the ADI**.
- It should always be compared with average consumption levels **over long periods**.

- ADI has been proved to be the best **practical tool** available for **legislators**.
- It has contributed to a **uniform** approach **around the world** to express the **safety** of a substance in relation to human consumption levels of additives.

METHODS OF ESTIMATING DIETARY INTAKE OF ADDITIVES

- Methods of estimating dietary food additive intake can be classified as either:

A. one-phase:

A one-phase method uses information from **one data source**, usually concerning **food additive production and usage**.

B. or two-phase:

A two-phase method **combines information from two data sources**; these usually concern additive concentrations in foods and food consumption.

- In the **two-phase** the investigator is required to **decide how** to combine the two different types of data to estimate the food additive intake

- **In duplicate meal studies**, both these types of information are collected from one source, which increases the accuracy of this method of intake estimation over the others.

A. One-Phase Methods

1. Estimation Based on Production and Foreign Trade:

- One **estimation** of food **additive** usage in a given country can be **calculated from the amounts of food additives**:
 - produced,
 - exported,
 - and imported by that country

- This **value** of additive usage by the food industry can then be divided by the total population to estimate an **average food additive intake**.
- It may also be necessary to take into account any **alternative uses** of the additives;

2. Surveys of Food Industry Usage

- **Records of the purchase or use of food additives by the food industry can be collected**
 - to estimate the total usage of additives.
- 
- **Dividing this amount by the number of consumers yields an estimate of the average intake of that food additive.**

- The **individual average daily intake** of each additive was estimated **by**:
 1. **Multiplying** the total substance **concentration** used in foods of each category **by** the **average** consumption of such foods on each eating occasion.
 2. This figure was in turn multiplied **by the frequency** with which the foods were consumed over the **14-day survey period**,
 3. and the result was divided **by 14** to obtain the **average daily intake**.

- In other method described by **Buchet and Lauwerys (1983)**,
 1. the **housewife** was the **reference person** who stored **duplicate** meals of all the foods she ate.
 2. The **sample** meals were stored in the domestic **refrigerator** until they were transported to the **laboratory** for analysis.

- The use of **duplicate meal samples** from large establishments, such as **hospitals**, may also be considered

because of the ease with which the preparation and collection of meal samples can be organized.

- **Advantages to using this experimental protocol.**
 1. **it provides accurate estimates** of food additive intakes of individuals and **realistic** variations of these intakes.
 2. Also, **food consumption** data and analytical data on **single** food items are **unnecessary** for such a study.

3. This experimental procedure could therefore be used to **assess** the **accuracy** of the other methods of estimating food additive intakes and thus be used to **validate** their results.

4. **Furthermore**, a duplicate meal study can be used **to ascertain** whether any significant **losses** or **gains** in additive content of foods occur during the **preparation** of those foods in the home.

B. Two-Phase Methods

1. Assumption of Maximum Permitted Levels
2. Market Basket Method

1. Assumption of Maximum Permitted Levels:

- This survey method was used by WHO to investigate the potential intakes of **54 additives**;
- And the **result** was that only three were found to exceed their corresponding ADIs.

This method is **based on the assumption** that the concentration of the food additive in each food **item is the permitted maximum.**

- The estimated daily intake is therefore calculated by:
 1. **multiplying the maximum** permitted level of additive in the food item **by the average consumption** of various food items (g/day).

2. This calculation is carried out for all the food items that may contain the additive, and the **sum** of the results gives **a total intake**.
 3. Subsequent studies using **analytical methods** revealed that actual consumption of various food additives rarely exceeds their ADIs.
- This leads to the conclusion that the use of maximum permitted additive concentrations in food **overestimates** the intakes **because**:

1. additives are **seldom** used in all the foods for which they have been approved.
 2. Even when they are used, their concentrations are usually below the maximum permitted levels.
- Therefore the **maximum permitted additive concentrations method** should be used for the estimation of additive intakes **only** when **analyzed additive concentrations are not available**.

2. Market Basket Method

- The market basket method, also referred to as a **total diet study**,
- **Carried as the following :**
 1. **selection** of food items representing the typical pattern of food consumption.
 1. The foods are **purchased** from shops and are then **prepared and cooked** (with herbs, spices, dressings, etc.) **to** incorporate the usual gains and losses of food additives.

3. The food items are then **sorted** into food groups (cereals, fats, fish, fruits, meats, oils, vegetables, etc.),
4. and the items of each group are **combined** according to the proportions in which they occur in the diet as indicated by **food consumption statistics**.
5. the **concentrations** of food additives in each food group are **determined**

6. The **daily food additive intake** for the food group is estimated by multiplying the measured **concentrations** of additives by the **average consumption** of foods in that food group.
7. An estimate of the **total intake** is the subsequent **sum** of the intakes calculated for each food group.

The accuracy of the information obtained in this type of study is dependent on:

1. the accuracy of determining the **initial construction** of the typical diet.
2. In addition, the **accuracy** of these estimates of additive intakes for the population of a country can **be increased** by:
 - a) taking into account any **regional differences** in food consumption,
 - b) And by incorporating **seasonal variations** of food consumption into the study

- **So In such studies, some factors must be taken into considerations:**
1. dietary habits,
 2. the effect of age distribution in the population,
 3. the degree of urbanization,
 4. and the type of shops available for the purchase of food samples need to be considered