Total Diet Studies: A Recipe for Safer Food

SUMMARY NOTES

- Chemicals find their way into food through intentional use or through contamination during production, processing and preparation.
- Chemicals can pose health risks to the populations if their presence exceeds their safety thresholds.
- Responsibility for monitoring the food supply for chemicals rests with governments.
- While the sampling and analysis of food can be expensive, the most cost-effective method for monitoring the food supply is the total diet study.
- Periodic total diet studies can provide general assurance that the food supply is safe from potentially toxic chemicals.
- Total diet studies can be used as a priority setting tool to assess whether contaminants as well as nutrients are at safe levels in the diet.

Why Total Diet Studies?
Chemicals are the building blocks of life and affect many, if not all, aspects of human metabolism. However, human exposure to toxic chemicals in food and nutritional imbalances are currently known or suspected to be responsible for range of human health problems, including promoting or causing cancer, kidney and liver dysfunction, hormonal imbalance, immune system suppression, musculoskeletal disease, and birth defects. Consequently, the protection of our diets from these hazards must be considered one of the essential public health functions of any country. This is the main purpose of total diet studies.

While unsafe levels of chemicals in food may cause serious health problems, they also pose threats to trade and the environment. It is estimated that the global economic and trade burden from these contaminants in food totals many billions of dollars annually. For developing countries, the foreign exchange earned from the exports of food is often essential for their economies, but may be subject to non-tariff trade barriers. It is therefore essential to have accurate information on people's actual total dietary exposure to toxic chemicals. In addition, total diet study results can be indicators of environmental contamination by chemicals and can be used to assess the effectiveness of specific risk management measures.

The World Health Organization (WHO) supports total diet studies as one of the most cost-effective means for assuring that people are not exposed to unsafe levels of toxic chemicals through food. WHO's Global Environment Monitoring System / Food Contamination Monitoring and Assessment Programme (GEMS/Food) has encouraged all countries and in particular developing countries to undertake total diet studies as a matter of public health significance, while recognizing the importance of total diet studies to standards development and trade and environmental management. GEMS/Food maintains two international databases on chemicals in individual foods as well as the total diet (see [http://www.who.int/foodsafety/chem/gems/en/index.html](http://www.who.int/foodsafety/chem/gems/en/index.html)).

What Are Total Diet Studies?
A total diet study consists of purchasing at retail level foods commonly consumed, processing them as for consumption, often combining the foods into food composites or aggregates, homogenizing, and analysing them for toxic chemicals and certain nutrients. Exposures through drinking water
and water used in cooking are included in the total diet study assessment. Total diet studies are designed to measure the average amount of each chemical ingested by different age/sex groups living in a country. These data are necessary to assess whether or not specific chemicals pose a risk to health.

Total diet study data differ from other chemical surveillance programmes because:

- they focus on chemicals in the diet, not individual foods,
- the foods are processed as for consumption in the home; thus, they take into consideration the impact of home cooking on the decomposition of less stable chemicals, and the formation of new ones, and
- assessments of background, rather than regulatory, concentrations of the chemicals in the foods are sought.

What Are The Costs And Benefits Of Total Diet Studies?
Because the studies are research oriented in nature, a high level of expertise and often more sensitive measurement instruments, such as high resolution mass spectrometers, are needed. However, many countries, including developed countries, do not need to establish sensitive analytical capabilities for all chemicals of interest. In fact, total diet studies can be used as a priority-setting tool to enable risk managers to focus their limited resources on those chemicals, both contaminants and nutrients, that pose the greatest risks to public health. For example, total diet studies in New Zealand revealed that the dietary intake of iodine was too low and becoming a nutritional problem, which then led to remedial action.

The cost of conducting a baseline total diet study is estimated to be about US$125 000, if a country already has basic information on food consumption. Such an expense should be weighed against the possible health and economic benefits that can accrue. In one developed country, a study of the economic impact on Parkinson’s Disease, hypothyroidism, diabetes and nervous system and IQ effects suggested that the current negative impact of previous and current human exposure to toxic chemicals in the diet, including nutritional imbalances, likely exceeds US$800 every year for every man, woman and child. This annual cost to the economies of developed countries does not include trade losses when contamination incidents are discovered. Yet, this cost to countries' economies can be reduced by lowering exposure to toxic chemicals and by optimizing nutritional balances. In addition, the negative economic impact can be expected to decrease with any increase in relevant research and monitoring activities.

What Are The Trade Implications Of Unsafe Chemicals In Food?
While total diet studies are health-oriented and population-based, such studies can often reveal point sources of contamination which can be corrected before the situation becomes a health or trade problem. However, even when health risks are low, the impact on trade can be severe. For example, contamination of a single batch of animal feed oil with dioxins and PCBs in Belgium resulted in economic losses exceeding US$2 billion.

In addition, the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures requires that health and safety decisions be based on sound scientific risk assessments. Besides toxicological data, risk assessments of chemicals in food need an assessment of human exposure. For this purpose, total diet studies are considered to be one of the best estimates of human exposure.

Governments Need To Act
Responsibility for the chemical safety of foods and the diet, quite often by default, rests with the government. As a practical matter, the primary responsibility for ensuring that individual food items are safe and meet national and international regulations and guidelines rests with industry. However, the overall assurance of safety is a government responsibility. In developing countries where industry conducts little or no testing of foods for chemical contaminants, it is imperative that government authorities take responsibility for ensuring that levels of chemical contaminants in the total diet - and by implication, individual foods - do not pose a significant risk to health to their populations.
In addition, because toxic chemicals in food cannot generally be detected by the senses or be removed by normal processing, consumer groups have also insisted upon effective measures by governments to protect them and their families against potentially toxic chemicals in food. Except for some high-value exports, few foods are regularly monitored in developing countries for compliance. Periodic total diet studies can provide some assurance about the safety of the food supply from toxic chemicals and offer guidance about the need for specific monitoring programmes. In addition, total diet studies can be used to establish priorities and assure that scarce government resources are used for the greatest health and economic benefits.

**Recent and Future Activities**

WHO through GEMS/Food has encouraged countries to undertake total diet studies. WHO in collaboration with national agencies has sponsored the three International Total Diet Study Workshops in Kansas City in July 1999, Brisbane in February 2002 and Paris in May 2004. These workshops have been increasingly successful in terms of both the numbers of participants as well as countries represented. Training course in total diet studies have always been held in tandem with the workshops. In the Paris training course, donated laptop computers, which were loaded with special software, were provided to the participants to facilitate their total diet studies back in their countries. Reports of these workshops are posted on the WHO food safety web site (see http://www.who.int/foodsafety/chem/gems/en/index3.html).

Building on the success of these workshops, WHO, in collaboration with the Institute for Nutrition and Food Safety of the Chinese Centers for Disease Control and Prevention and in cooperation with the Food and Agriculture Organization of the United Nations (FAO), recently held the Fourth International Workshop on Total Diet Studies in Beijing from 23 to 27 October 2006, which was attended by over 50 participants from 34 countries. In addition, an introduction to total diet studies was held for 25 persons from developing countries before the workshop from 16 to 20 October 2006. One of the recommendations of the workshop was a request that regional workshops be held to disseminate more broadly the importance of total diet studies. Regional workshops are being discussed for 2007 in the WHO Regions of Africa, Europe, the Eastern Mediterranean and Southeast Asia. Countries interested in participating in these regional workshops should visit the WHO Food Safety, Zoonoses and Foodborne Diseases Department Website at www.who.int/foodsafety/chem or contact the GEMS/Food Manager at foodsafety@who.int. Given the primary importance of total diet studies for risk assessment purposes, countries should also consider approaching the Standards and Trade Development Facility for possible support (see http://www.standardsfacility.org/).

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