

# **CONDUCTING TOTAL DIET SURVEYS FOR PESTICIDE EXPOSURE**

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Food safety is an important issue worldwide and national authorities are responsible for ensuring the safety of the food supply. Two survey systems are commonly used for food safety purposes. One is the inspection monitoring program of residues in food raw commodities for enforcement purposes by comparing the residues with national tolerances based on the food hygiene law. Another one is the “Total Diet Study (TDS)” where food is sampled based on consumption rate, prepared ready to eat and analyzed for substances and contaminants. From this information a dietary exposure estimate is calculated and compared to international health standards such as the Acceptable Daily Intake (ADI) for pesticides(1), Provisional Tolerable Weekly Intake (PTWI) for contaminants elements and Recommended Dietary Intake (RDI) for nutrient elements.

The goal of the total diet studies is to generate the most reliable estimate of dietary intake of food-borne contaminants for different population groups and determine whether this intake is within acceptable health standards. The TDS was initiated in 1961 in USA to monitor the radionuclide contamination.(2) , and has since developed by increasing the food commodities tested, extending the range of contaminant analysis and including an estimation of dietary exposure to particular contaminants and substances from ready to eat foods. TDSs have become a key tool for food safety evaluation and are commonly used in many countries. The First Total Diet Study in Taiwan (TTDS) is authorized by the Department of Health and carry out by Taiwan Agricultural Chemicals and Toxic Substances Research Institute (TACTRI) in year 2003 and 2004.

The process of a Total Diet Study consists of purchasing foods that are most commonly consumed, processing them to ready to eat state, homogenizing the foods into food composites or aggregates, and analyzing the foods for the specific substances. The analytical results are combined with food intake information for different population groups, and the dietary intakes of the chemicals by the groups are estimated. The framework of Total Diet Study including following 5 steps.

1. Food lists: The food selected for Total Diet Study should be intended to represent the average and typical intakes of national people, and be able to develop simulated diets for the population groups that are being considered. The food consumption data used in the Taiwan total diet study were developed from results of 1993-1996 Nutrition and Health Survey in Taiwan(3). GEMS/Food commodity grouping and coding system with some modification are used to structure the 20 food classifications in Taiwan Total Diet Study. Individual foods that have been selected from the food consumption data to represent similar items are grouped on the basis of food type and nutrient content to generate a food list (4). The Taiwan TDS developed 130 commodities in food list including 20 core foods, 66 national foods and 44 regional food.
2. Sampling and food preparation: Food samples were collected on eight occasions separate to four seasons during the year of 2003 and 2004. Purchased foods were sent to the laboratory within 24 hours, with the fresh food preparation occurring within 48 hours. The prepared samples are stored in -20 °C for further analysis. Total 4551 samples were collected and 1709 ready to eat food samples were prepared for analysis.
3. Sample analysis: All foods samples were tested for 181 pesticides , cadmium, iron, Lead, nickel, chromium and zinc. Selected foods were analyzed for arsenic, mercury, aflatoxins and dioxins. The multi-residue analysis methods for 181 pesticide residues and 9 dithiocarbamate fungicides are modified from CNS (Chinese National Standards) approved methods and described in approved

SOPs (5,6). ISO17025 is followed as a general requirement for quality assurance.

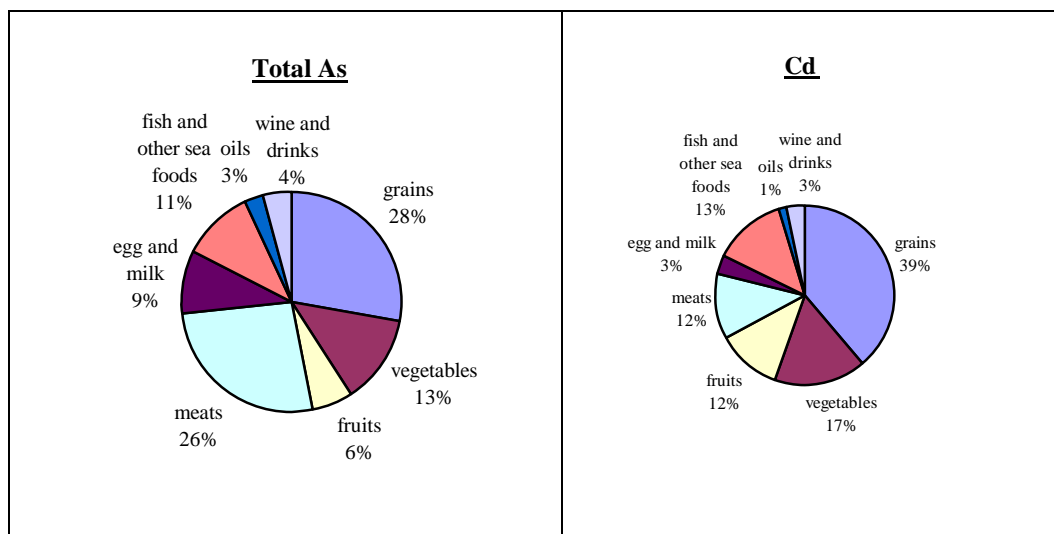
4. Results and dietary exposures estimate: The analytical results of chemicals and contaminants in the whole diet is compared to international health standards such as ADI for pesticide residues and PTWI for contaminants and other substances. Dietary risk assessment created 10 age-sex groups as 13-16 , 16-19, 19-31, 31-51, 51-65 years (male and female) with different body weight and dietary intake.

5. Regulatory and administrative follow-up if necessary.

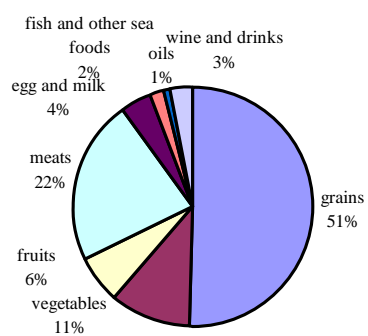
A total of 47 different pesticide residues were detected out of the 190 compound screened for in the 2003/2004 TTDS. 1268 samples (74.2 %) were not found the detectable residues. Prothiofos contribute 25.12% ADI on dietary intake. Fruits group contained more residue ratios (57.7%) then other groups. The estimated weekly dietary exposures to total Arsenic for the ten age-sex groups are less then 2.2% PTWI, grains and meat contribute more concentrations of total arsenic. Mercury only tested for seafood samples and contribute 2.6% PTWI. The contribution of heavy metals in the TTDS study representative with % PTWI were cadmium 69.4%, lead 40.8%, nickel 27.1%, copper 2.6%, chromium 53% and zinc 10.3%. Aflatoxin B1, B2, G1 and G2 were not detected on selected grain products, 56% dairy samples contain detectable Aflatoxin M1. Dioxins were analyzed on .245 food samples including meat, fish, egg, dairy and oils .less then 36% PTMI contribution from dietary intake.

#### References:

- [1] Wong SS. 2008. ADI List (Acceptable Daily Intakes for Pesticides) pp.80, published by Department of Health, Executive Yuan, Taiwan.
- [2] Laug EP, Mikalis A, Bollinger HM, and Dimitroff JM. 1990. Total diet study 1963. Section A: strontium-90 and cesium-137 content. Section B: nutrient content. Section C: Pesticide content. J. Assoc. Off. Anal. Chem. 73(5): 644-660
- [3] Pan WH., Chang YH, Chen JY, Wu SJ, Tzeng MS, and Kao MD. 1999. Nutrition and health survey in Taiwan (NAHSIT) 1993-1996: dietary nutrient intakes assessed by 24-hour recall. Nutr. Sci. J. 24(1): 11-41.
- [4] Ireland J.D and Møller A. 2000. Review of International Food Classification and Description J. Food Comp. Anal. 13: 529-538.
- [5] Anon. 1995. Method of test for pesticide residues in foods-multi-residue analysis (I). Chinese National Standard. N6276-1.
- [6] Anon. 2000. Method of test for pesticide residues in foods-Multi-residue analysis (III). Chinese National Standard. N 6276-3. *Figure The contribution of Total As, Cd, Cr and Pb in food groups of 1<sup>st</sup> Taiwan TDS*



## Pb



## Cr

