FDA's Total Diet Study: Estimating Dietary Intakes

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Introduction

- Brief overview of FDA's TDS

- TDS methodology for estimating dietary intakes

  - Derivation of the "TDS diets"

- Comparison of TDS diets to other food consumption estimates

Total Diet Studies

- Purpose is to:
    - measure levels of various substances in foods as consumed
    - estimate average dietary intakes of the substances

- Involve purchase and analysis of foods representing all components of the diet

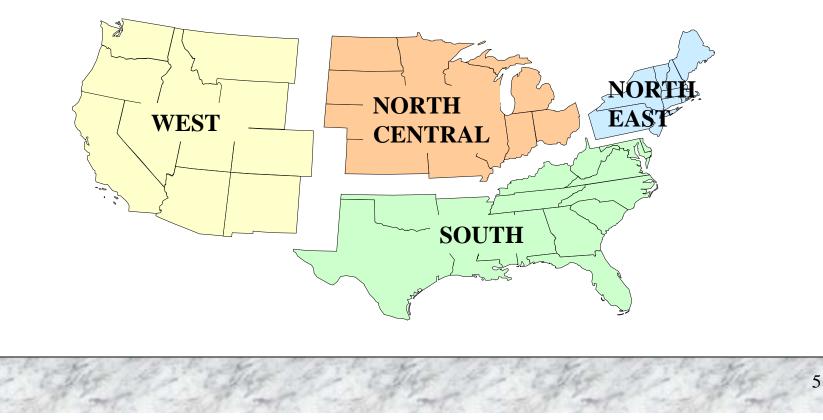- Focus on the average diet rather than extreme or atypical consumers

FDA's TDS

- Conducted continuously since 1961

- Current study design:
  - 4 market baskets (MB) per year
  - ~ 280 foods/beverages (TDS food list)
  - ~ 400 analytes (pesticide residues, toxic & nutrient elements, chemical contaminants)
  - Estimated dietary intakes for total US population + 14 age/gender groups

Sample Collections

- 4 regional market baskets each year
  - For each MB, samples of each TDS food are collected in 3 cities

TDS Food List

- Includes major components of the average diet

- Limited to retail foods available nationwide

- Based on national food consumption survey results (CSFII, NHANES)

- Revised periodically (about every 10 years) to reflect changing dietary patterns

Sample Preparation

- TDS foods are prepared 'table ready'
  - Deionized water used for washing and cooking foods
  - No salt added in cooking

- For each MB, 3 samples of each TDS food are combined to form 1 analytical composite per TDS food =
  - ~ 280 composites per MB
  - ~1120 composites per year

TDS Analytes

Each TDS food composite is analyzed for:

- Pesticide residues (>300)

- Industrial chemicals (43)

- Radionuclides (13)

- Elements (4 toxic, 14 nutrient)

- [Dioxin (since 1999); acrylamide (since 2003); perchlorate, furan (since 2004)]

TDS Dietary Intake Estimates

Dietary intake =
analyte concentrations in food
x amount of food consumed

Concentrations = TDS analytical results

Consumption amounts = TDS diets

TDS Diets

- A set of consumption estimates derived on a per-capita (eaters and non-eaters) basis
  - for each TDS food
  - for each of 15 population groups

- Current TDS diets are based on 1994-98 CSFII

- Reflect consumption of <u>all foods and beverages</u> reported in the CSFII

- Allow for a quick and consistent estimation of total intake of TDS analytes

Compiling the TDS Diets

- 1994-98 CSFII
  - Each food/beverage reported in the survey is assigned an 8-digit code
  - ~6,000 food codes in all

- TDS diets
  - Incorporate all 6,000 survey foods via aggregation of food codes and consumption amounts

Aggregation of CSFII Codes

- Each CSFII code was assigned to the most similar TDS food (creation of mapping file)

  - For individual foods, aggregation usually based on commodity or crop group

  - For mixed dishes/multi-ingredient foods, aggregation based on similarity of the major ingredients

- Food form and cooking method considered where possible

Example of CSFII Code Aggregation

TDS food # 84: Applesauce

CSFII food code	CSFII Food Description
62101200	Apple, dried, cooked
62101230	Apple, dried, cooked, with sugar
63101110	Applesauce/stewed apples, NS as to added sweetener
63101120	Applesauce/stewed apples, unsweetened
63101130	Applesauce/stewed apples, with sugar
63101140	Applesauce/stewed apples, with low calorie sweetener
63101150	Applesauce with other fruits
63101210	Apple, cooked or canned, with syrup
63101310	Apple, baked, NS as to added sweetener
63101320	Apple, baked, unsweetened
63101330	Apple, baked, with sugar
63101420	Apple, pickled
63101500	Apple, fried

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Aggregation of CSFII Consumption Amounts

After CSFII codes were aggregated:

- Per-capita consumption amounts for each survey food for each of 15 populations were calculated

- Survey foods and consumption amounts were regrouped by TDS food

- Consumption amounts for survey foods assigned to each TDS food were summed to get the TDS diet consumption amounts

Example of Consumption Amount Aggregation

TDS food # 84: Applesauce

CSFII food code	CSFII Food Description	Total US per-capita consumption (g/day)
62101200	Apple, dried, cooked	0.001
62101230	Apple, dried, cooked, with sugar	0.009
63101110	Applesauce/stewed apples, NS as to added sweetener	0.694
63101120	Applesauce/stewed apples, unsweetened	1.252
63101130	Applesauce/stewed apples, with sugar	1.290
63101140	Applesauce/stewed apples, with low calorie sweetener	0.063
63101150	Applesauce with other fruits	0.028
63101210	Apple, cooked or canned, with syrup	0.039
63101310	Apple, baked, NS as to added sweetener	0.030
63101320	Apple, baked, unsweetened	0.081
63101330	Apple, baked, with sugar	0.132
63101420	Apple, pickled	0.008
63101500	Apple, fried	0.095

Total per-capita consumption =
TDS diet amount for applesauce   **3.7**

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TDS Intake Estimate:
Intake of ChemX from Applesauce

TDS results for applesauce:

Market Basket	ChemX conc (mg/kg)
2004-1	0.012
2004-2	0.012
2004-3	ND
2004-4	0.010
2005-1	0.014
2005-2	0.007
2005-3	0.012
2005-4	0.013
Average	**0.010**

TDS Intake Estimate:
Intake of ChemX from Applesauce

TDS population group	TDS Diet consumption amount for applesauce (g/person/day)	Mean ChemX concentration in applesauce (mg/kg)	ChemX intake from applesauce* (μg/person/day)
Total US	3.72	0.01	0.04
M/F 2 yr	5.42	0.01	0.05
M/F 6 yr	6.11	0.01	0.06

Consumption Estimates: TDS Diets v. CSFII Raw Data

Same consumption data – slightly different estimates

- TDS diets
  - incorporate all CSFII food codes
  - based on per-capita estimates only

- Analysis of CSFII raw data can be based on
  - food codes or commodity codes (FCID)
  - selected food/commodity codes
  - eaters only or per capita

TDS Diets v. CSFII Raw Data

TDS food: Applesauce

CSFII food code	CSFII Food Description	Per-capita consumption (g/day)
62101200	Apple, dried, cooked	0.001
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Total per-capita consumption = TDS diet amount for applesauce   **3.7**

TDS Diets v. CSFII Raw Data
(Food and Commodity Codes)

Total US

Per-capita consumption (g/person/day)

	applesauce	*apples*
TDS diets	3.72	13.91
CSFII food code	3.33	13.78
CSFII commodity code (FCID)	3.48	15.20

TDS Diets v. CSFII Raw Data (Food and Commodity Codes)

M/F 6 years

Per-capita consumption (g/person/day)

	applesauce	_apples_
TDS diets	6.11	19.78
CSFII food code	6.11	19.61
CSFII commodity code (FCID)	5.78	20.24

TDS Intake Estimates
- Applications -

- TDS results provide reasonable estimates of
    - average chronic/long-term intake
    - background intakes/exposure
    - trends in intake
- Intakes based on TDS diets are <u>not</u> appropriate for assessing
    - acute intakes (eaters only)
    - upper percentile intakes
    - intakes from foods or population subgroups other than TDS foods/subgroups

TDS Diets and Related Files

Details are posted on CFSAN's website:
http://www.cfsan.fda.gov

Program Areas/Chemical Contaminants

<u>Total Diet Study</u>
- TDS food list
- CSFII food code aggregation (mapping file)
- TDS diets

Analytical Results

- TDS analytes posted on CFSAN's TDS website:
  http://www.cfsan.fda.gov/~comm/tds-toc.html
  - Individual data (as .txt files)
  - Data summaries by analyte and/or food

- Additional analytes (dioxin , acrylamide, perchlorate, furan) posted elsewhere on CFSAN pesticides and chemical contaminants website:
  http://www.cfsan.fda.gov/~lrd/pestadd.html

- Scientific publications

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