



Beltsville Human Nutrition
Research Center

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Fatty Acid Data in the USDA National Nutrient Databank: Data handling and currency issues

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Topics to be Covered

- Enhancements to the USDA Nutrient Databank System useful to fatty acid (FA) handling
- Retail and industrial fats and oils that have been added to the USDA National Nutrient Database for Standard Reference
- Difficulties in keeping fats and oils data current with the marketplace

USDA Nutrient Databank System

Databank System

- Initial (data entered)
- Aggregation
- Compilation
 - Missing nutrients imputed for items in the survey subset
 - Nutrient data and weights finalized for dissemination
 - Quality control checks run

Major Products

USDA National
Nutrient Database
for Standard
Reference, Rel.20

~ 7,500 foods

Survey Subset

~ 2,800 foods



**Food and Nutrient
Database for
Dietary Studies**

Enhancements in the Databank System (NDBS) Useful for Fatty Acid Handling

- Can enter fatty acid, or any other data, in the unit as received. The system converts the data to the nutrient's dissemination unit/100 g food
- Can include additional fatty acids and isomers
 - Specific isomeric data for 18:3 n-3 and for 18:3 n-6; system generates total 18:3 undifferentiated.
 - trans-vaccenic 18:1-11t (18:1t n-7) added to the NDBS. [This isomer occurs naturally in ruminants.]

Fatty Acid Conversions at Data Entry

Methyl
esters

Butyl
esters

% FA of
total fat

FA TG/100 g food

Converted to SR dissemination unit:
g fatty acid/100 g food

Other Enhancements: Data summations and adjustments

- NDBS calculates fatty acid class totals:
 - SFA, MUFA, and PUFA
 - Total *trans* fatty acid (TFA)
- Adjustments in the FA data can be made at Compiled stage of NDBS
 - Adjustment to a new fat level
 - Adjust individual fatty acids to their respective fatty acid class data

National Food and Nutrient Analysis Program (NFNAP)

- A research program designed to improve nutrient values in the NDBS through nationwide sampling and analyses performed by qualified universities or commercial laboratories on foods identified as high contributors of nutrient(s) of public health significance.
- Major fats or oil-based products sampled under the first phase of NFNAP:
 - Industrial oils, shortenings, and margarines
 - Margarines and spreads (re-sampled 2006)
 - Retail shortenings
 - Salad dressings

Industrial Oils, Shortenings & Margarines

- ISEO helped identify industrial fats and oils needed to calculate missing values for survey items
- Samples were collected from industry contacts
- Products described in SR by oil source, hydrogenation, and principal uses of the product
- These ingredients reflecting fats used in commercial foods are being used as in the Nutrient Data Lab's formulation program, a major imputation tool for commercial multi-ingredient foods
 - This program uses linear programming to estimate a formulation based on targeted known nutrient values and label ingredients

Types of Industrial Oils Sampled

Source	# of samples	Uses include...
Corn	1	All purpose retail/industrial
Sunflower	1	Frying, salad dressings
Canola	3	Salad dressings, frying (light and heavy)
Coconut	3	Candy, oil sprays, whiteners
Palm kernel/palm	6	Toppings, confections
Soy	7	Varied, from frying to icings

Types of Industrial Shortenings and Margarines

Shortenings	Margarines
Soy (PHO) liquid fry	Soy, soy (PHO) baking, sauces, candies
Soy (PHO), corn frying	Cottonseed, soy (PHO) flaky pastries
Soy (PHO) baking, confections	PHO = partially hydrogenated oil
Soy (PHO), cottonseed, soy pastries	

SR20 Fatty Acid Profiles (g/100 g) for Margarine and 60% Fat* Spreads

	80% fat stick (margarine)	80% fat tub (margarine)	60% fat stick (spread)	60% fat tub (spread)
SFA	15.2	14.2	10.9	12.1
MUFA	38.9	36.4	29.7	19.3
PUFA	24.3	26.7	16.7	26.5
TFA	14.9	5.8	12.7	3.7
18:1t	14.2	5.2	11.9	3.4

* 60% fat is the predominant fat level consumed in the US

SR20 Fatty Acid Profile for 37% Fat Vegetable Oil spread

FA class	g FA/100 g spread
SFA	8.6
MUFA	14.0
PUFA	12.4
TFA	1.4*

* 0.19 g/14 g serving, considered 0 g trans fat for labeling purposes

Reformulations of Crisco[®] Shortening

Years sampled	Total trans fat, g/100 g	Ingredient oils
1990-1993 and again in 2000	Mean = 15.8	PHO soybean & PHO cottonseed
2005 the 0 trans product	0.6	sunflower, soybean, fully hydrogenated cottonseed
Early 2007 the only product is now 0 trans fat	2.9	soybean; fully hydrogenated cottonseed; PHO cottonseed & PHO soybean

Techniques Being Used by the Edible Oil Industry to Reduce TFA

- Modification of the chemical hydrogenation process to produce partially hydrogenated oils with low TFA
- Production of oil seeds with modified fatty acid composition by breeding and genetic engineering
- Use of tropical oils, e.g. palm, palm kernel, coconut
- Interesterification of mixed fats

Examples of Plant Breeding for New Oils

- Reducing the PUFA content of oilseed – early example development of hi oleic sunflower oil in Russia in 1976, in US in 1983. Patent holders on hi-oleic seed licensed their mid-oleic for development by others
- NuSun mid-oleic germplasm lines developed by ARS
- Other trait-modifiable oils now available include mid-oleic soybean, low linolenic soybean and canola, high oleic canola
- Note: breeding is a slow process, requiring 6-8 years

Sunflower Oil Comparisons

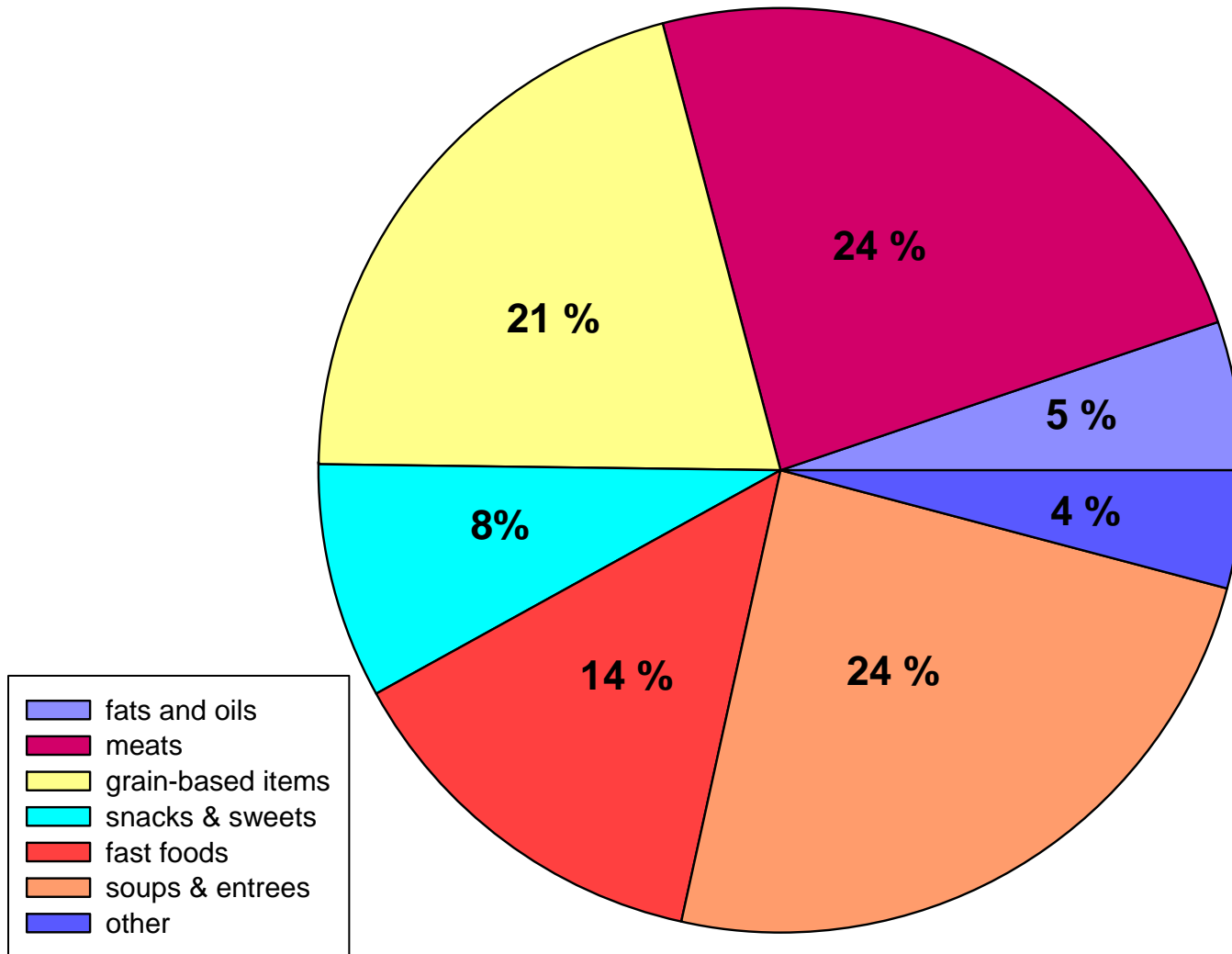
	Traditional linoleic sunflower oil, NDB# 04506	NuSun mid-oleic sunflower oil, NDB# 04642
SFA	10.30	9.01
MUFA	19.50	57.33
18:1c	19.50	57.03
PUFA	65.70	29.96
18:2 n-6	65.70*	28.70
18:3 n-3	0.00*	0.04
TFA	NA	0.22

* older data -- values were not for the specific n-3 and n-6 isomers

Number of Total Trans Fat Values in the SR Database

Release	Year	Items with total trans fat values
SR14	2002	2
SR15	2002	50
SR16-1	2004	135
SR17	2004	236
SR18	2005	481
SR19	2006	823
SR20	2007	1213

Availability of Trans Fat Data by Food Type



Comparison of Analytical vs Formulation Values for Fatty Acids in Chocolate Sandwich Cookies with Creme Filling *

Fatty Acid	Analytical value g/100 g	Imputed Value g/100 g
18:1	8.4	8.4
18:2	3.2	2.8
18:3	0.4	0.7

* Oil ingredients as listed on food label: high oleic canola oil and/or palm oil and/or canola oil

USDA/Agricultural Research Service
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www.usda.ars.gov/nutrientdata