



# Dietary CLA Intake in Humans

## What do we know? What should we know?

**Shelley McGuire, Ph.D.**

Department of Food Science and Human Nutrition  
Washington State University, Pullman, WA USA

**Mark McGuire, Ph.D.**

Department of Animal and Veterinary Sciences  
University of Idaho, Moscow, ID USA

# Background



- ✿ Parodi (1977) identified CLA in cow's milk.
- ✿ CLA is found naturally in foods from ruminant animals
  - Smaller amounts in other meats and oils (?)
- ✿ Most publications documenting CLA content of foods have focused on beef and dairy products.
- ✿ CLA supplements now also being consumed.

# Dietary Intake Methodologies

## ✦ Food Frequency Questionnaires

- Estimates *chronic* intakes of individuals
- Asks “do you eat cheese?; how often?; how much?”
- Limited by
  - Completeness of questionnaire
  - Ability of person to recall accurately
  - Adequacy of nutrient database for foods

# Methodologies, cont.

- ✦ Weighed, Written Diet Records (usually 3 d)
  - Record of *current* intake
  - More difficult for subjects
    - May change intake behaviors
    - Difficult for children
  - Completeness and accuracy of nutrient database key



# Methodologies, cont.

## ✱ Chemical Analysis of Food Duplicates (3 d)

- Gold Standard
- Most labor intensive for subjects
  - May change intakes (collecting food is not easy or convenient)
  - Difficult for children
- More expensive
- Accuracy limited by ability to *chemically* analyze composite foods.

# Published Estimates of CLA Intake

<b>Nation</b>	<b>Subjects</b>	<b>Method</b>	<b>CLA Intake (mg/d)</b>	<b>Reference</b>
Australia	Adults	NR	500-1000	Parodi, 1994
U.S.	Adults	NR	1000	Ip, 1994
U.S.	Adults	Diet records	127	Herbal, 1998
Germany	Adult Males	FFQ	430	Fritsche, 1998
Finland	Adults, High Dairy	Diet records	310	Salminen, 1998
	Adults, Low Dairy	“	90	“
U.S.	College-Aged Males	Diet records	137	Ritzenthaler, 1998
	College-Aged Females	“	52	“
U.S.	Lactating Women, High Dairy	Diet records	291	Park, 1999
	Lactating Women, Low Dairy	“	15	“
Finland	Adult Women	FFQ	132	Aro, 2000

# Effect of Methodology on Estimates

## ✿ Subjects

- Males;  $n = 46$ ; age:  $32 \pm 2$  yr
- Females;  $n = 47$ ; age:  $30 \pm 2$  yr
- Healthy, free-living
- Methods used
  - Food frequency questionnaire
  - 3-d weighed, written food records
  - Biochemical analyses of 3-d food duplicates

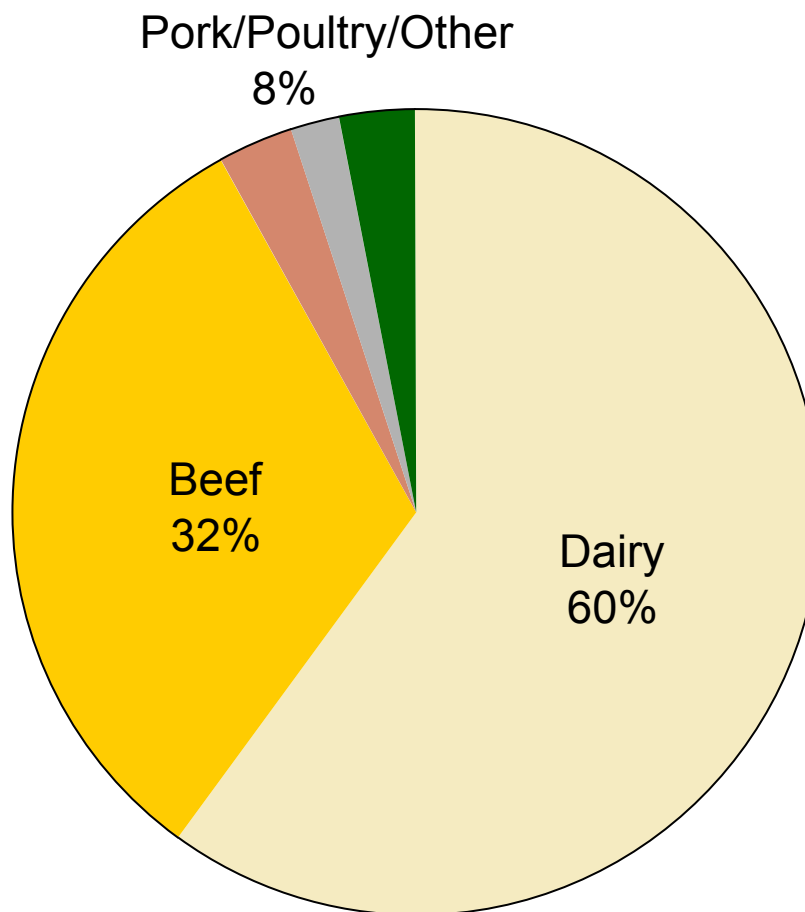


# CLA Database

- ✿ “Total CLA” and c9,t11-CLA (rumenic acid; RA) content of foods obtained from published ( $n = 9$ ) and unpublished data.
- ✿ Data entered into computerized dietary assessment program
  - Food Processor<sup>®</sup>, ESHA Research, Salem, OR
  - 190 food items

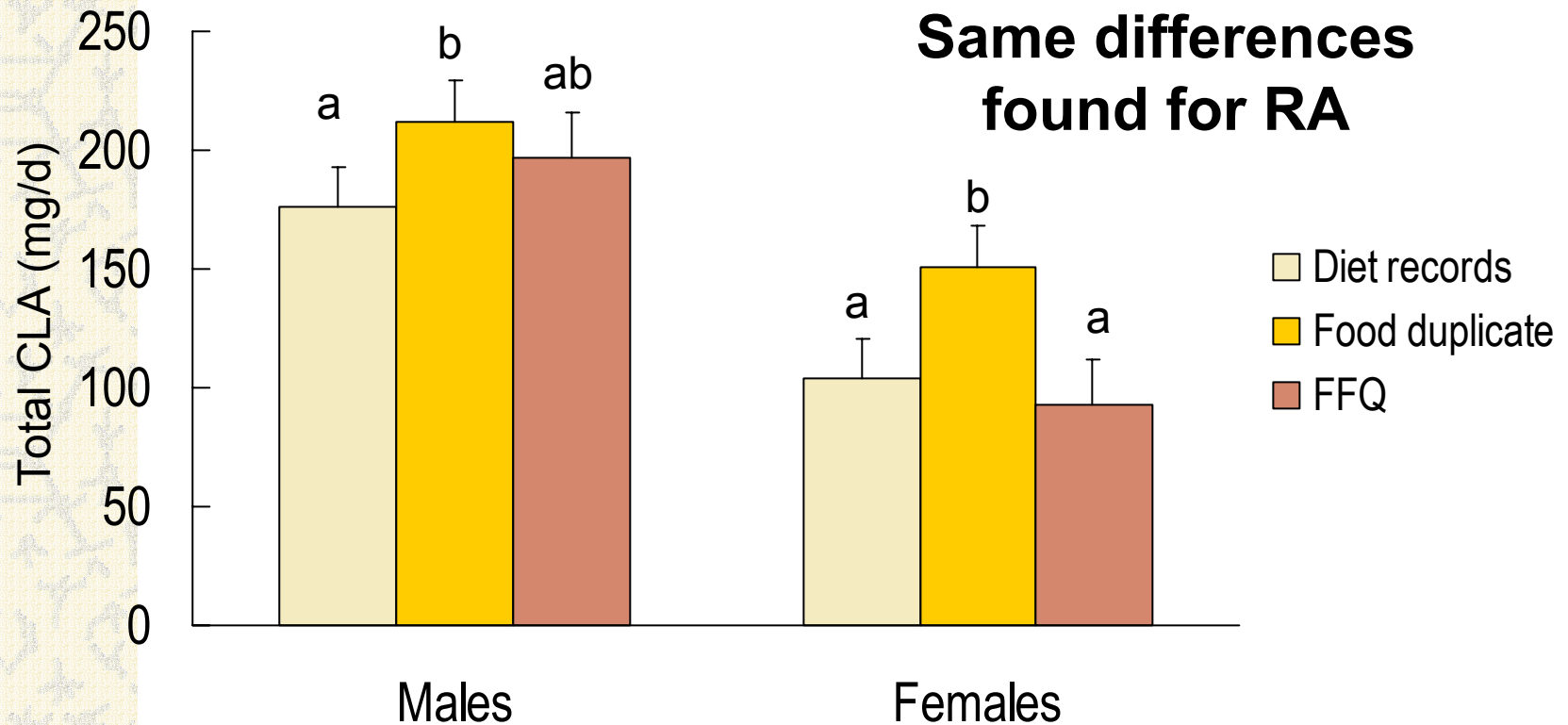


# Dietary Sources of CLA Written Food Records



**This, of course, reflects nature of database.**

# Estimates by Methodology “Total CLA”



# Some Conclusions

- ✿ Majority of CLA/RA from dairy products.
- ✿ Males consumed more than females.
- ✿ Written records and FFQ underestimated intakes.
  - Under-reporting on written records and FFQ?
  - ***Inadequate CLA/RA database?***
- ✿ What about other age groups?



# CLA Intakes in Early Life. Why Should We Care?

Major focus of my research program.

Dietary “programming” during growth and development?

# Cancer Initiation/Prevention in Early Life

- ☀ Breast cancer may be initiated prenatally or in early life.
  - de Waard et al., 1988; Anbazhagan et al., 1994
- ☀ CLA (specifically RA) consumption during “adolescence” in rats has lasting impact on ↓ risk of mammary cancer.
  - Ip et al., 1995,1997,1999
- ☀ Maternal consumption of linoleic acid **during pregnancy** ↑ risk for mammary cancer in female offspring.
  - Hilakivi-Clarke et al., 1996,1997,1998

# Breastfeeding and Breast Cancer

- ✿ Having been breastfed ↓ risk of mammary cancer in later life (baby)
  - Titus-Ernstoff et al., 1998
  - Increased exposure to anticarcinogenic lipids like CLA?
- ✿ Breastfeeding ↓ risk of mammary cancer (mom)
  - Ing et al., 1977; McTiernan et al., 1986; Yoo et al., 1992; Siskind et al., 1989; Newcomb et al., 1994
  - Increased exposure of breast tissue to anticarcinogenic lipids like CLA?
- ✿ Summary: lactation/breastfeeding may impart protection against mammary cancer for mom and infant.

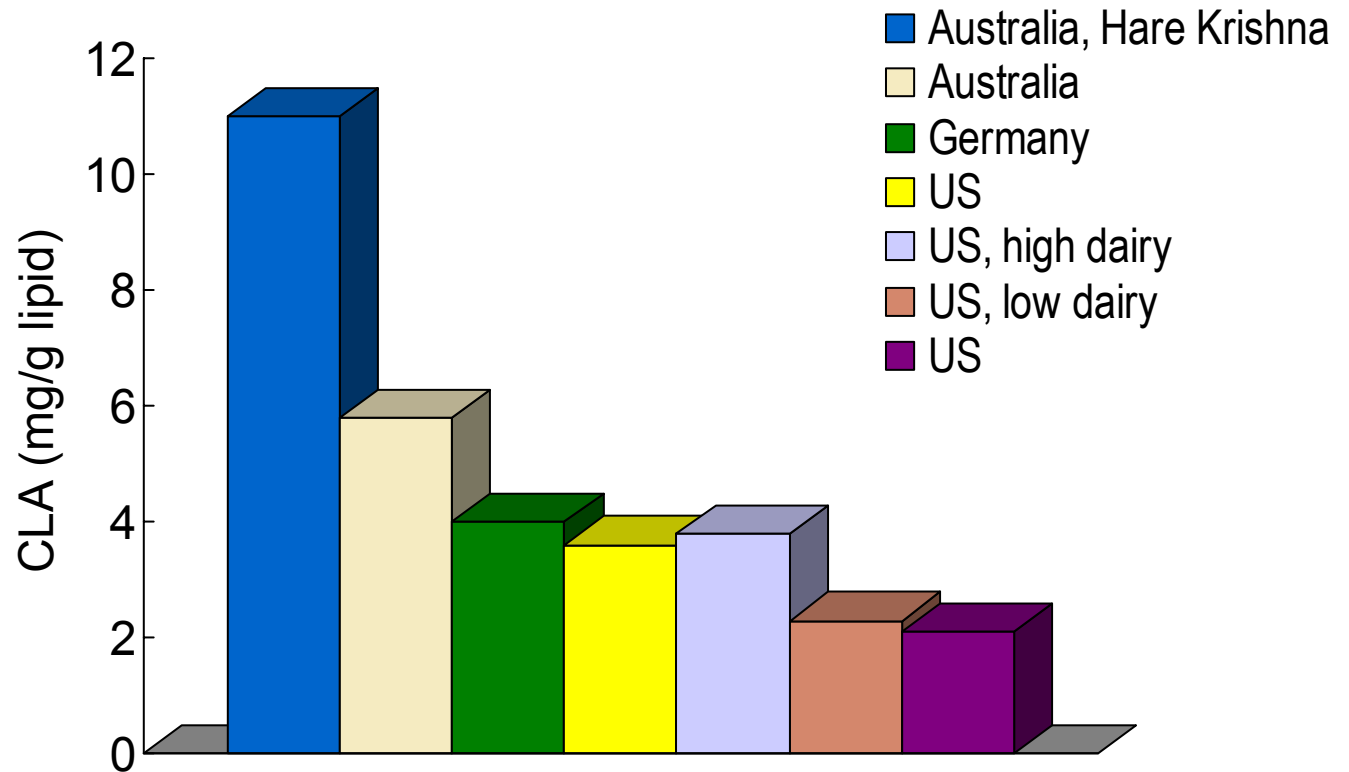
# CLA Intake by Infants

- ✦ Myriad CLA isomers in human milk
- ✦ CLA in human milk, but not infant formula sold in U.S.
  - McGuire et al., *Nutr Res* 1999





# Estimates of Human Milk CLA



# Nutritional Regulation of Infant CLA Intake

- ✱ Maternal CLA consumption → ↑ human milk CLA.
  - High dairy fat
    - Park et al., *Lipids*, 1999
    - Anderson et al., *FASEB*, 2002
  - CLA supplements
    - Masters et al., *Lipids*, 2002
  - CLA-enriched cheese
    - Ritzenthaler et al., *FASEB*, 2002
- ✱ Infant CLA consumption related to maternal diet.

# CLA Intake in Breastfed Babies

## ✿ Subjects

- Exclusively breastfeeding women ( $n = 10$ ); healthy infants

## ✿ Methods

- Complete breast expression at each nursing for 24 h
- Representative milk sample collected from each nursing session.
- Composite sample analyzed for RA
- Milk consumption estimated by 24 hr “weigh back” method
- RA intake calculated
  - milk consumption x RA concentration of milk

# Breastfed Babies, results

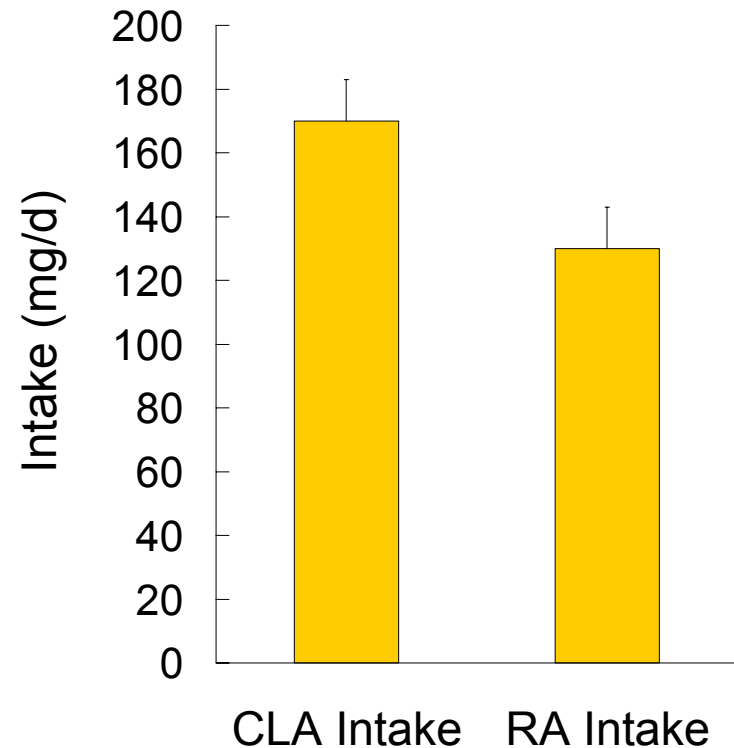
<b>Parameter</b>	<b>Mean <math>\pm</math> SEM</b>
Milk RA (mg/g)	0.34 $\pm$ 0.09
Milk Fat (%)	4.05 $\pm$ 0.51
Milk Consumption (g/d)	790.4 $\pm$ 130.7
RA Intake (mg/d)	108.2 $\pm$ 34.3
RA Intake (mg/kg/d)	20.0 $\pm$ 8.9

# CLA Intake

## School-Aged Children

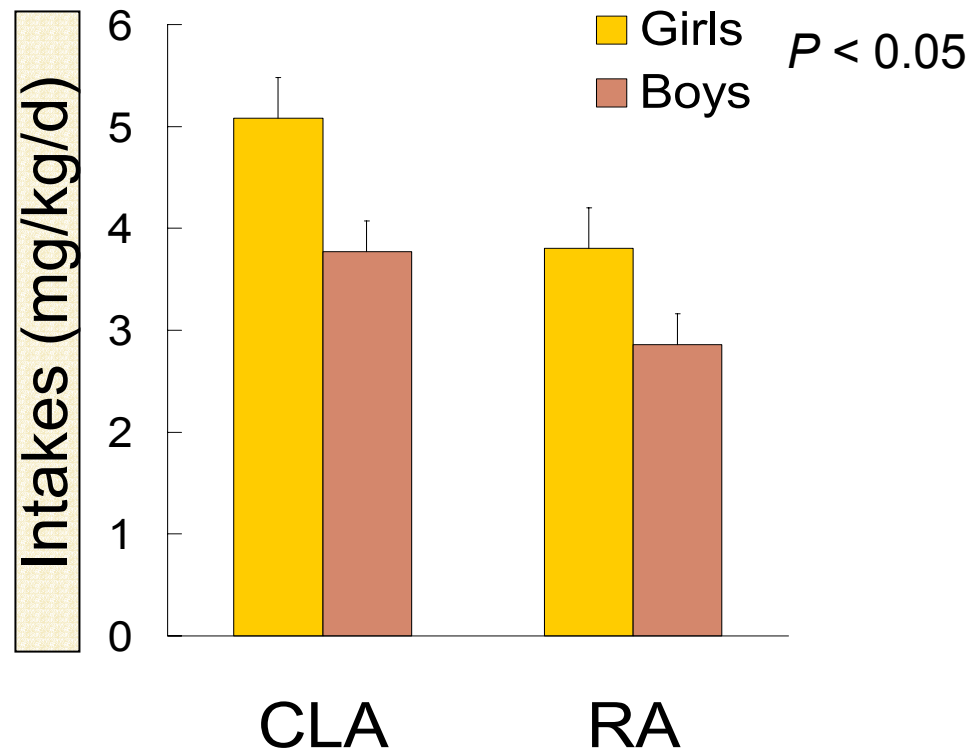
### ✦ Subjects

- Boys ( $n = 20$ ; 10.0 y)
- Girls ( $n = 20$ ; 10.3 y)
- 3-d weighed, written food records
- Most data collected in summer



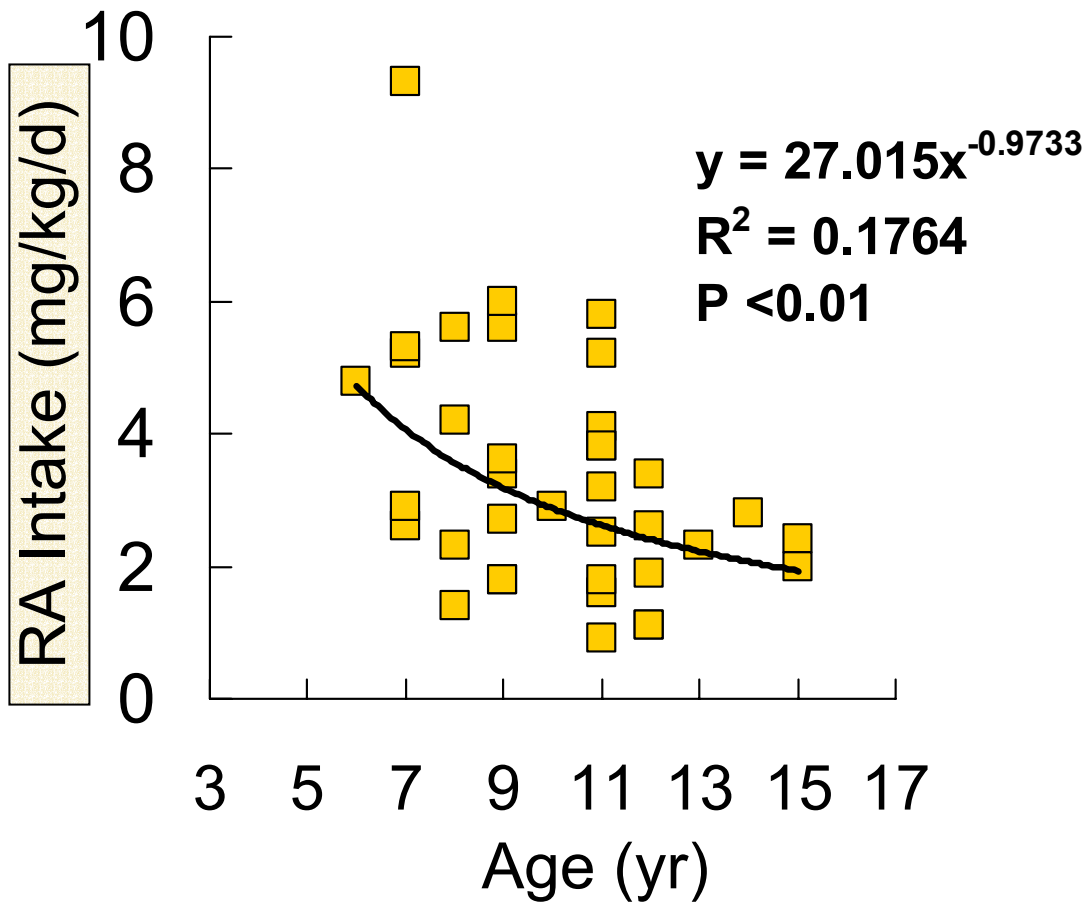
Edwards et al., unpublished data

# Effect of Gender on CLA Intake



Edwards et al., unpublished data

# Effect of Age



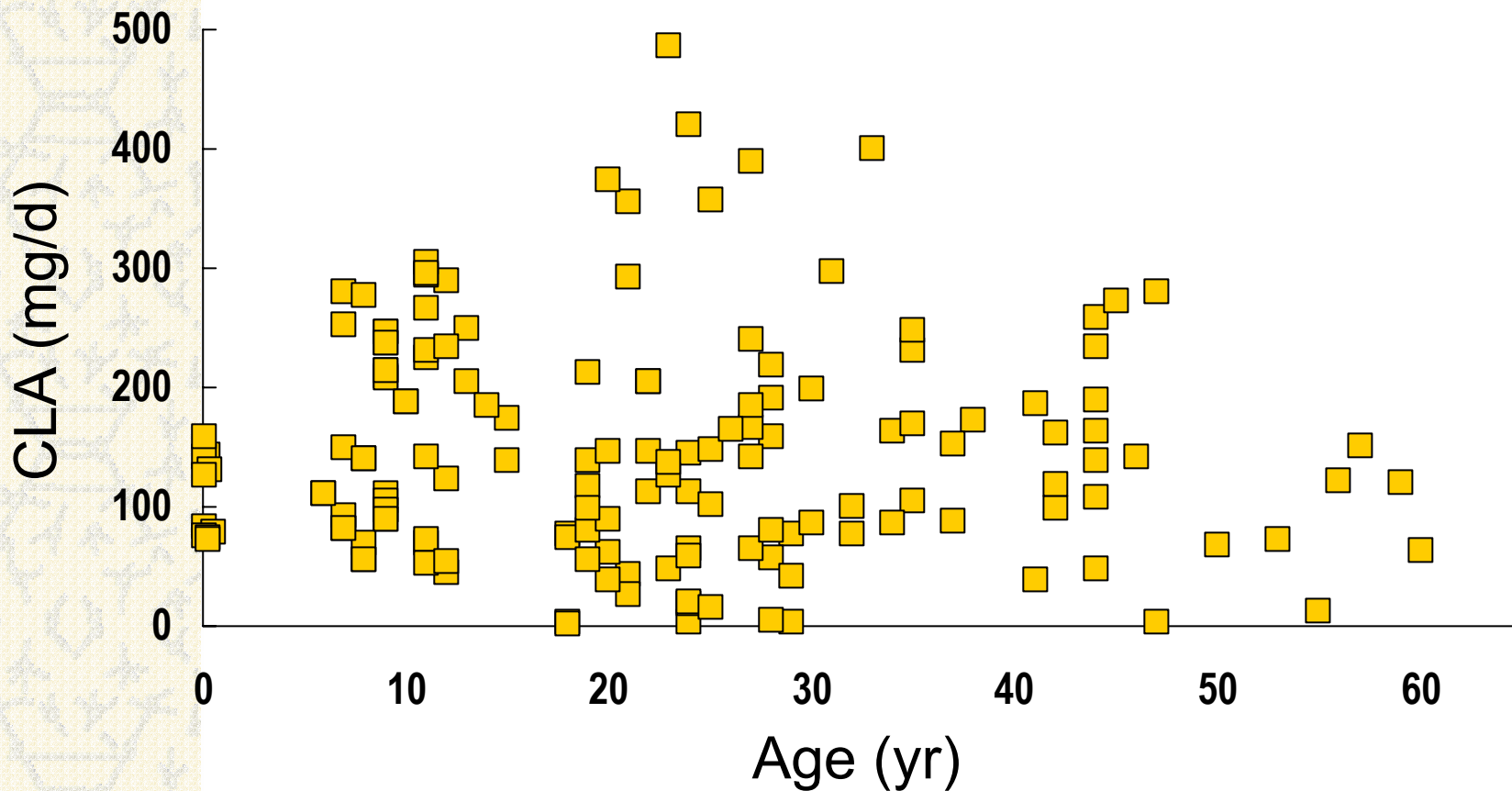
Edwards et al., unpublished data





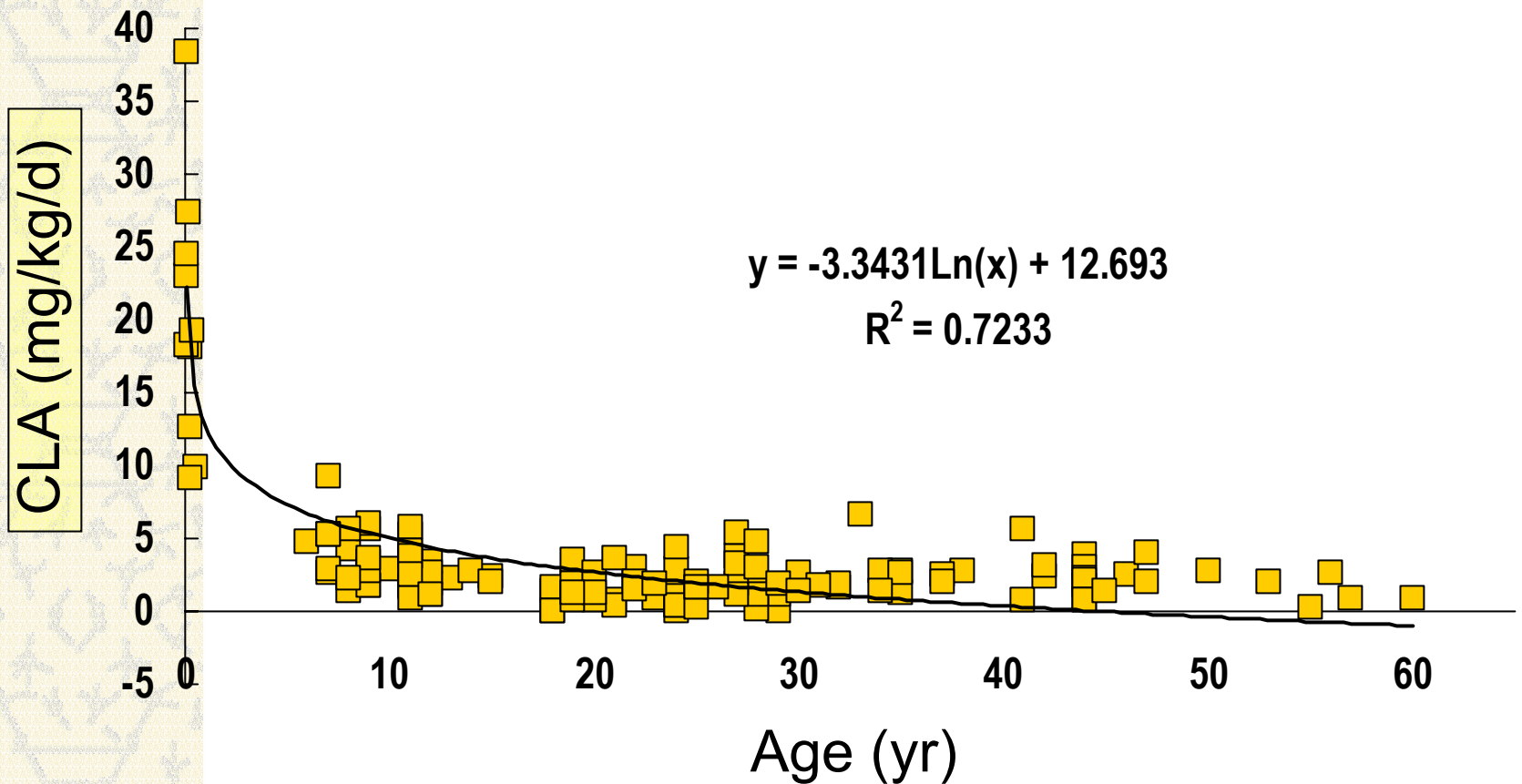
# Summary of Intake Data

# CLA Intakes Over Lifespan U.S. Data



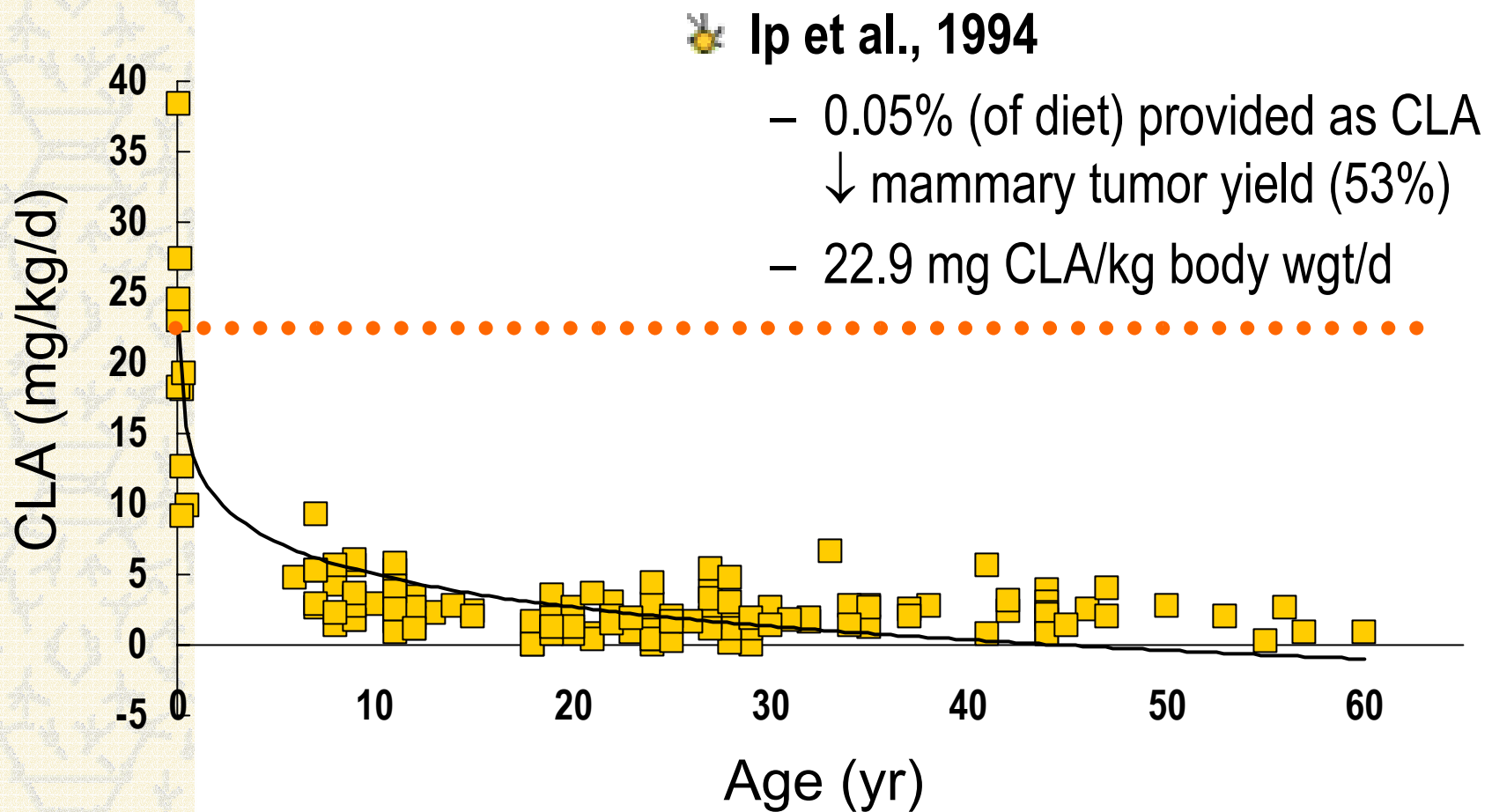
Harrison et al. & Edwards et al., unpublished data; Ritzenhaller et al., 2001

# CLA Intakes Adjusted for Body Weight



Harrison et al. & Edwards et al., unpublished data; Ritzenthaler et al., 1999

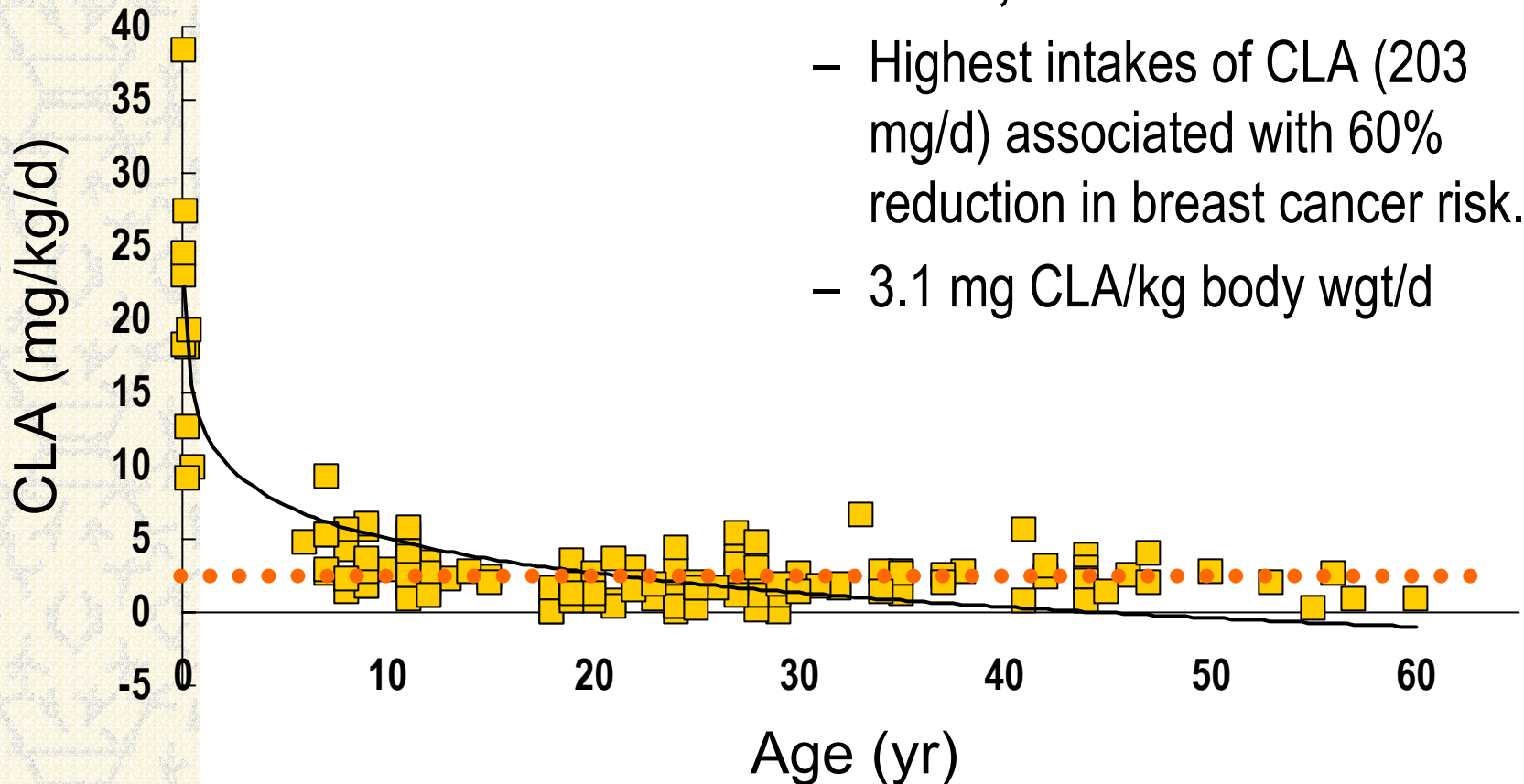
# Are we getting enough?



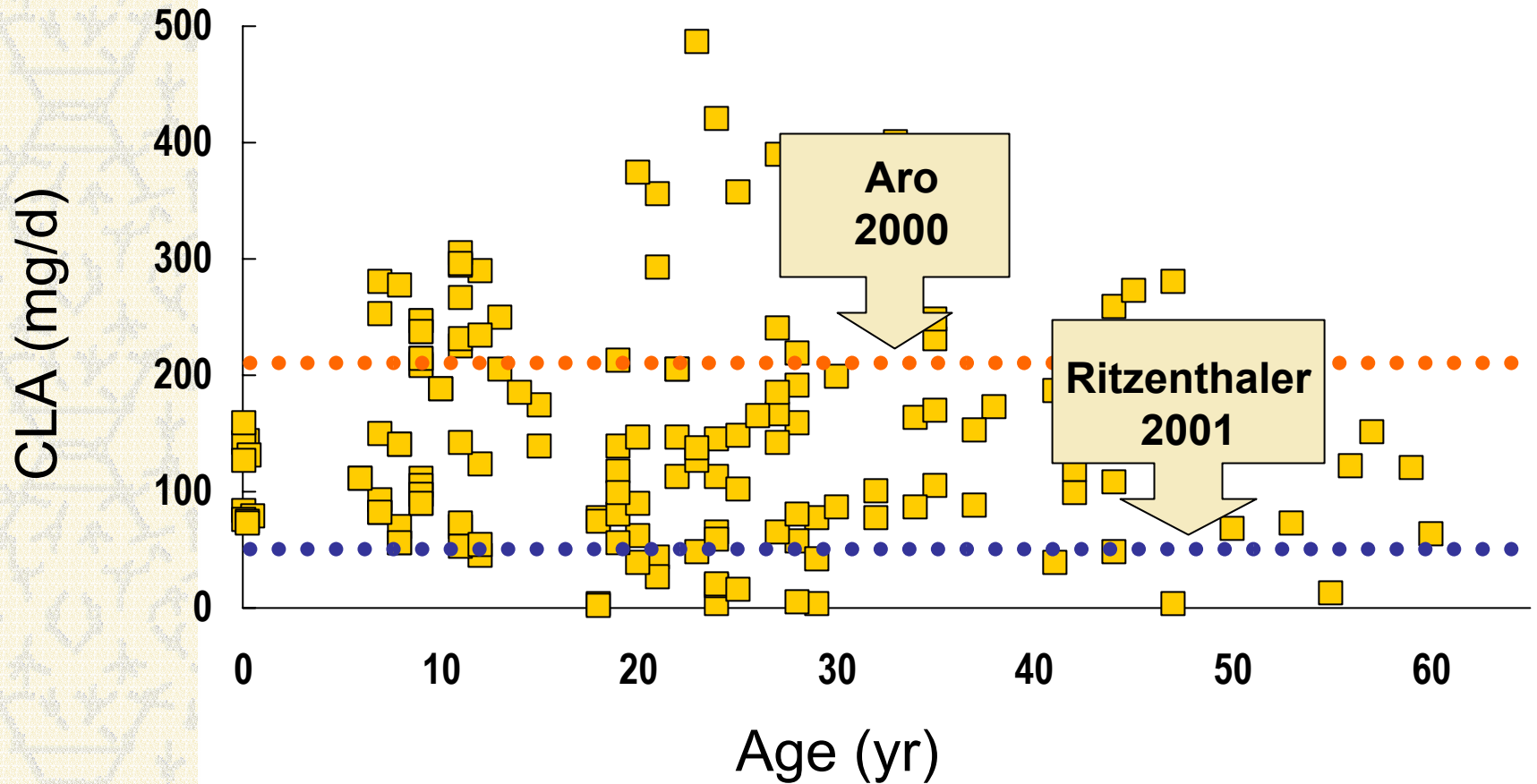
# Are we getting enough?

## ☀ Aro et al., 2000

- Highest intakes of CLA (203 mg/d) associated with 60% reduction in breast cancer risk.
- 3.1 mg CLA/kg body wgt/d



# Enough?



# Limitations to Current Knowledge

- ✦ Inadequate food database
  - Need more foods
    - Do we really understand CLA content of foods?
    - Example: margarine
  - Need isomeric CLA concentrations
    - Can we realize biological benefits of CLA by diet?
    - Can agricultural practices be developed to aid in this goal?
    - Do we have to rely on pharmacological doses (i.e., supplements)





# Limitations, cont.

- ✿ Need to document intakes in meaningful ways.
  - mg/g food (dry weight basis)/d
  - mg/d
  - mg/kg body weight/d
- ✿ Better yet, need to identify biological indicators of chronic/current CLA intake
  - Blood lipid fraction
  - Cheek cell samples?
- ✿ Diet vs. endogenous synthesis?
- ✿ Continue to investigate CLA intakes throughout the lifespan.

