Dairy and Childhood Health: A Focus on Bone and Obesity

Joseph M. Kindler, Ph.D.
Department of Nutrition Science
Purdue University
West Lafayette, Indiana, USA

Better Foods for Better Health
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Outline

- Dairy recommendations
- Dairy and bone health
- Dairy and obesity
- Summary and conclusions

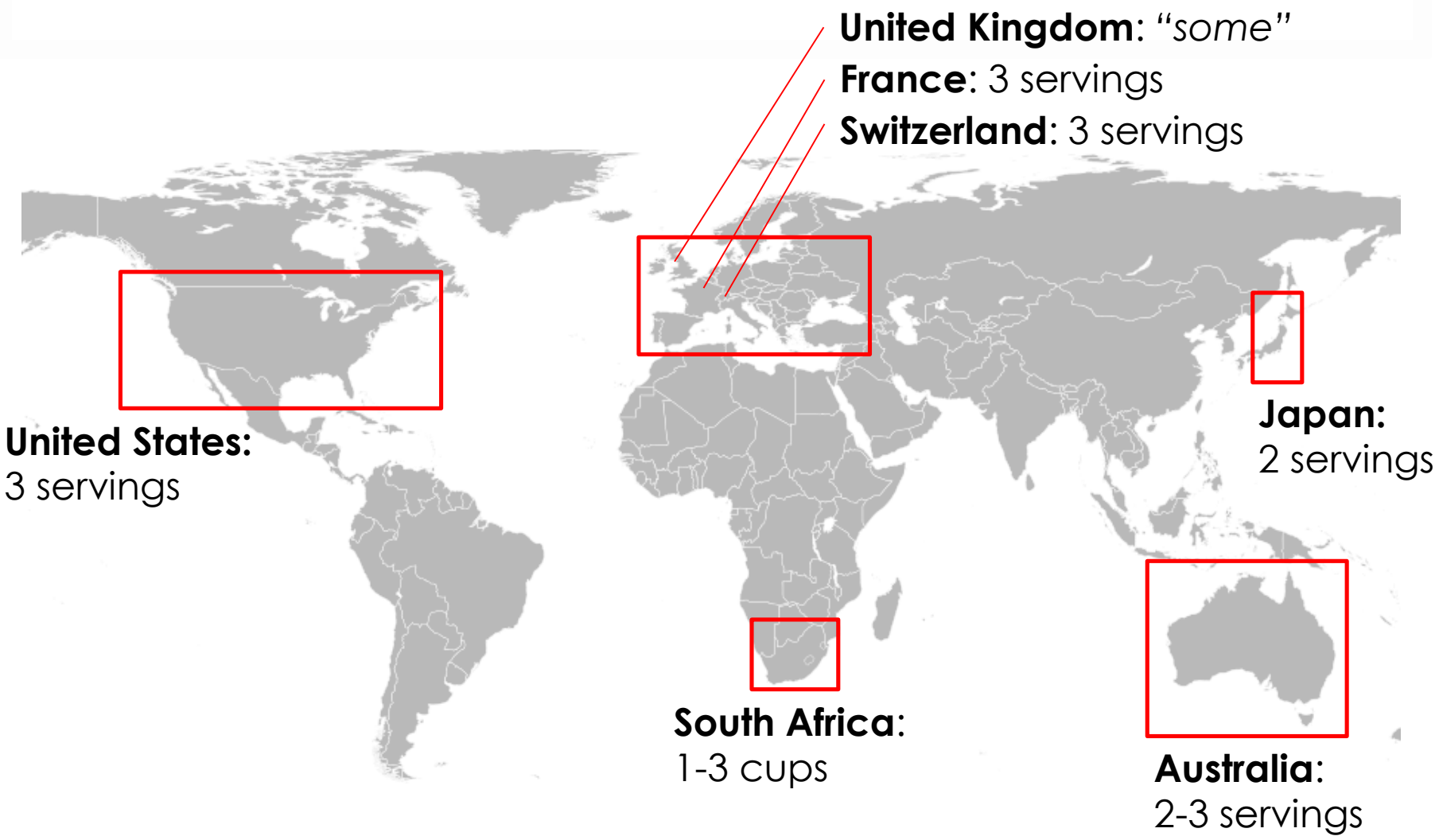
Dairy Recommendations in the United States

Recommended Servings of Dairy Per Day*		
Children	2-3 years	2 cups
	4-8 years	2.5 cups
Adolescents	9-13 years	3 cups
	14-18 years	3 cups

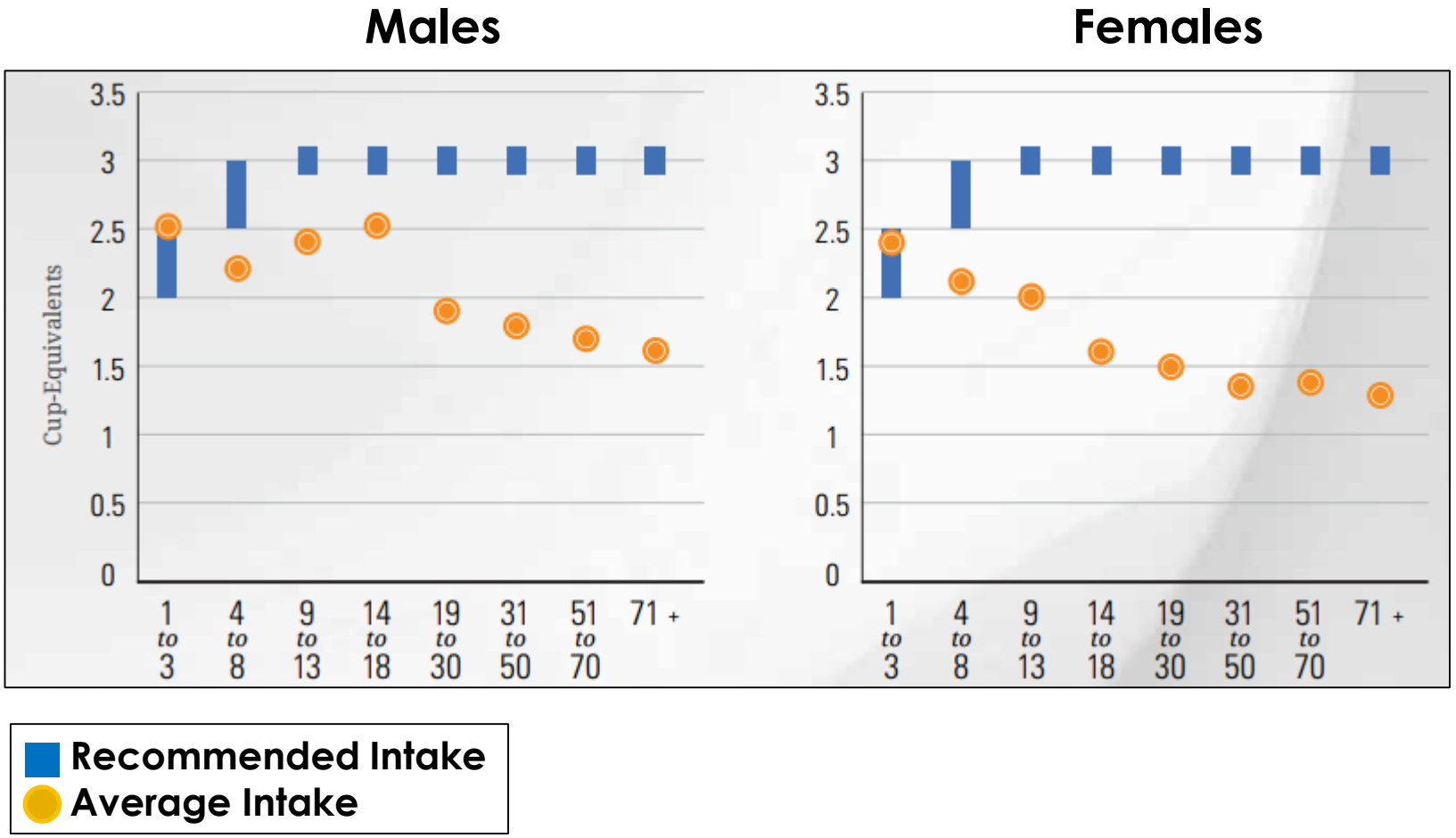
* US recommendations support low-fat milk, yogurt, cheeses, and fortified beverages

2015-2020 US Dietary Guidelines for Americans

Dairy Recommendations Around the Globe



Dairy Intake Compared to Recommendations



2015-2020 US Dietary Guidelines for Americans

Nutrients from Dairy

Calcium

Vitamin D

Protein *(high quality)*

Magnesium

Potassium

Phosphorus

Vitamin A

Vitamin B-1
(Thiamin)

Vitamin B-12

Zinc

Vitamin B-2
(Riboflavin)

Selenium

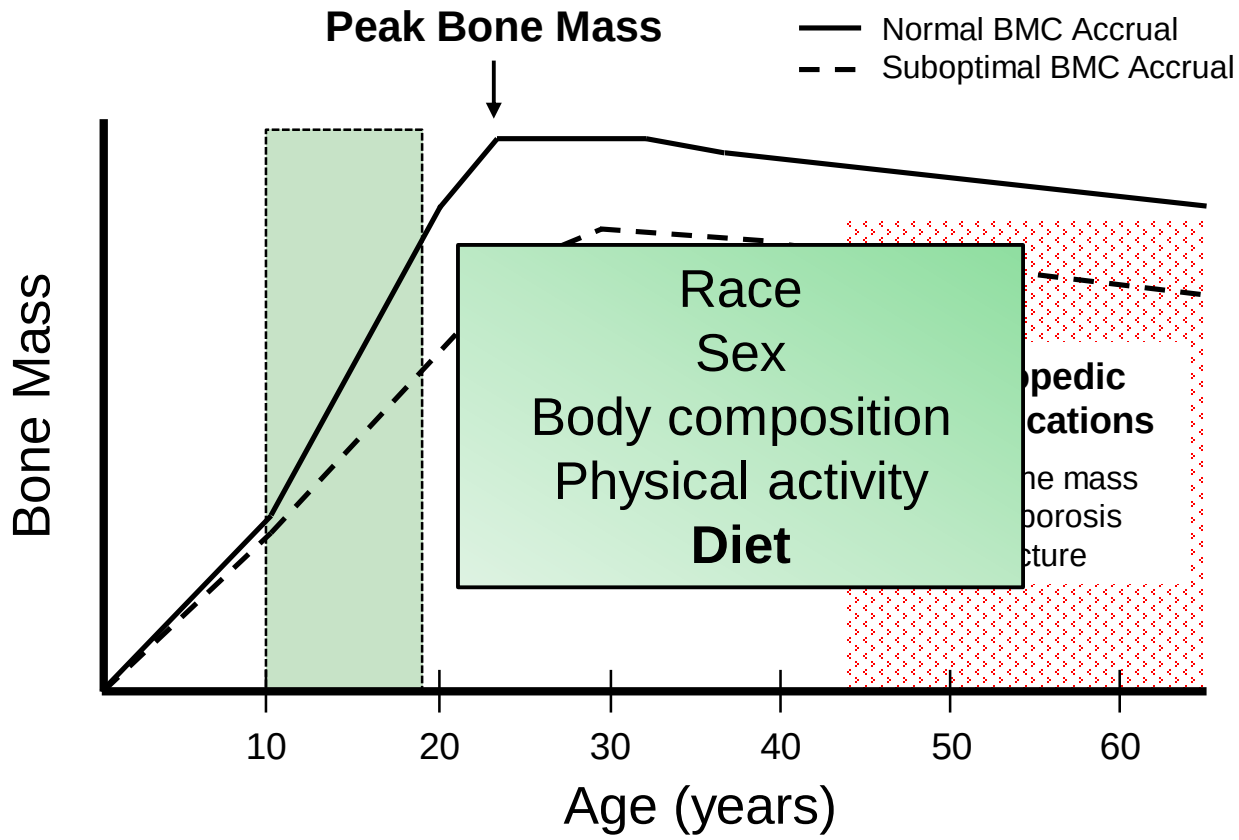
Dairy and Childhood Health

Bone health

Obesity

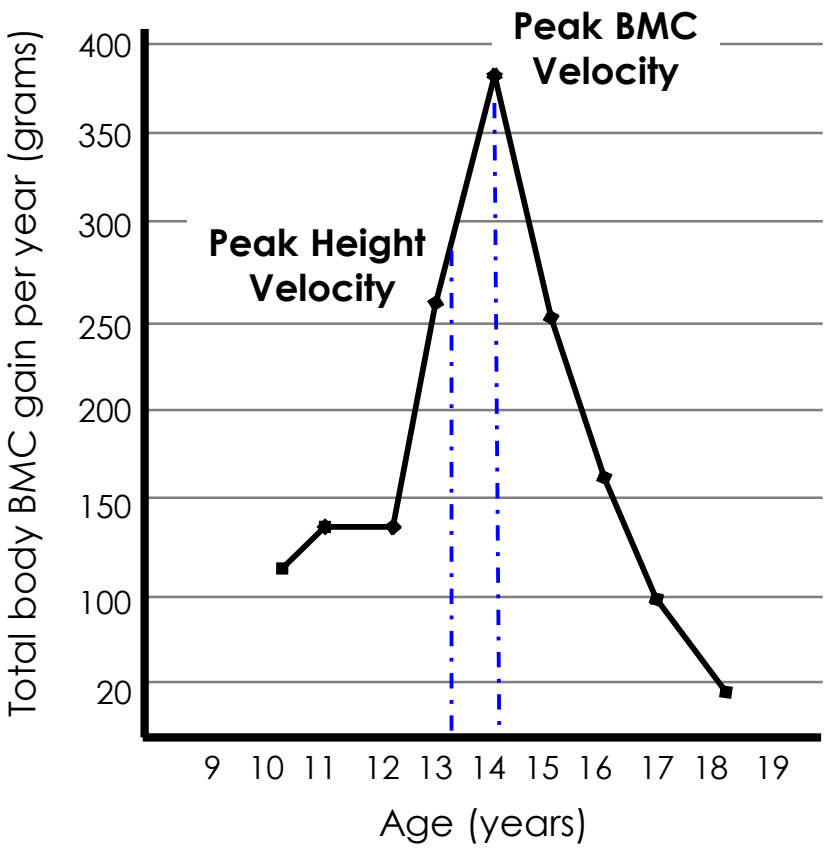
Peak Bone Mass

- Adolescence is a critical period of bone growth
- About 90% of adult bone mass is accrued by the age of 20 years



Weaver et al Osteoporos Int, 2016

Dairy and Height/Bone Mass Velocity



Percent <u>not</u> meeting dairy recommendations: **~70%**

Low **Ca**, K, Mg, Vitamin D, etc.

Low bone mass
Skeletal fracture

Weaver et al Osteoporos Int, 2016

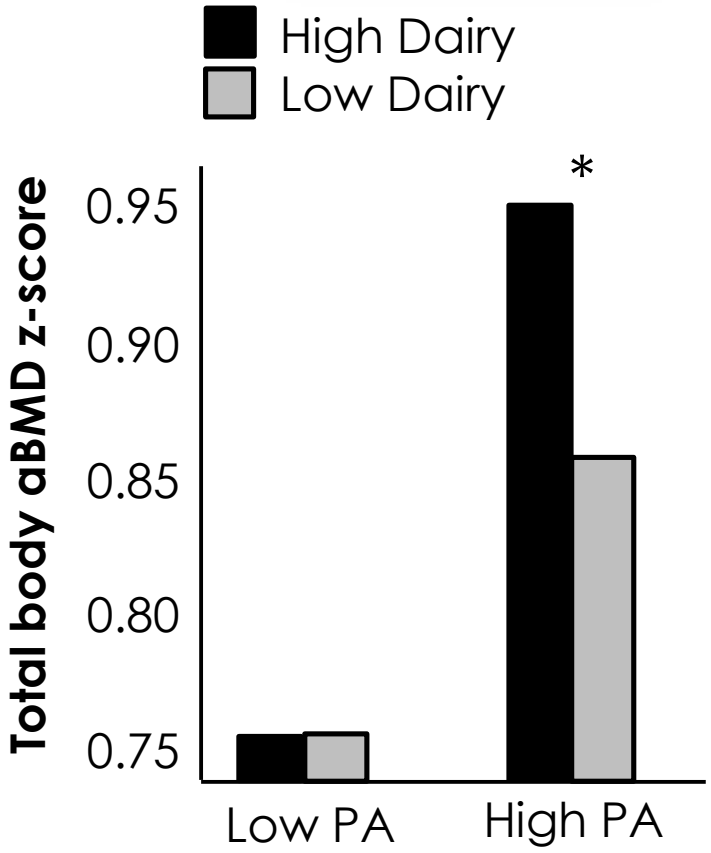
Milk Consumers vs. Milk Avoiders

- **Early pubertal girls (USA)**
  - Perceived milk intolerance was inversely associated with bone mass at several skeletal sites
- **Children (New Zealand)**
  - Milk avoiders were shorter and had lower bone mass at several skeletal sites versus those who consumed milk
  - Fracture risk was greater in milk avoiders versus milk consumers

Goulding et al J Am Diet Assoc, 2004; Matlik et al Pediatrics, 2007

Dairy and Bone Mass:
An Additive Influence of Physical Activity?

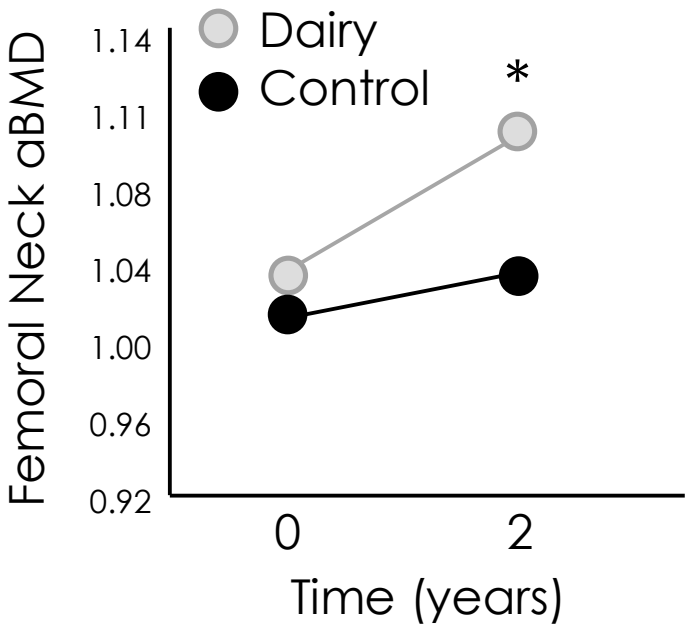
- Belgian boys and girls ages 6-12 years
- Dairy consumption measured via food frequency questionnaire
- Physical activity measured using accelerometry
- Total body aBMD measured using DXA
- **Results**: Dairy consumption and physical activity were positively associated with aBMD. The relationship between dairy and aBMD was strongest in those who were more physically active



Sioen et al BMC Public Health, 2015

Dairy Consumption and Bone Mass

- Healthy girls ages 15-16 years (N=91)
- 2-year intervention
  - Dairy (1000 mg Ca/day)
  - Control
- Dairy products included:
  - Milk
  - Flavored milk
  - Dairy dessert
  - Cheese
  - Yogurt
- aBMD measured via DXA
- **Results**: Dairy group had greater gains in aBMD at the trochanter, lumbar spine, and femoral neck



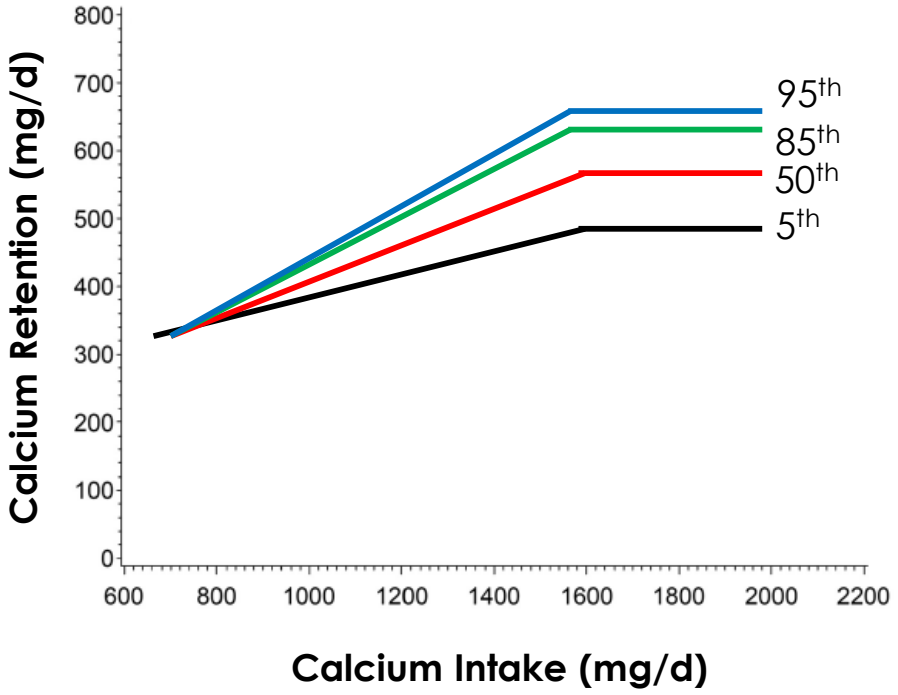
***** indicates significant difference in change from baseline between control and supplement groups (P<.05)

Merrilees et al Eur J Nutr, 2000

Dairy and Bone Health:
…does obesity matter?

Obesity and Calcium Retention

- Analysis of pooled data from 3-week calcium balance studies
- White, Black, and Asian boys and girls ages 10-16 years (N=280)
- Calcium retention = Ca intake – fecal Ca – urinary Ca
- **Results**:
  - At low Ca intake, BMI had no influence on Ca retention.
  - At higher Ca intake, calcium retention was enhanced in overweight and obese adolescents.



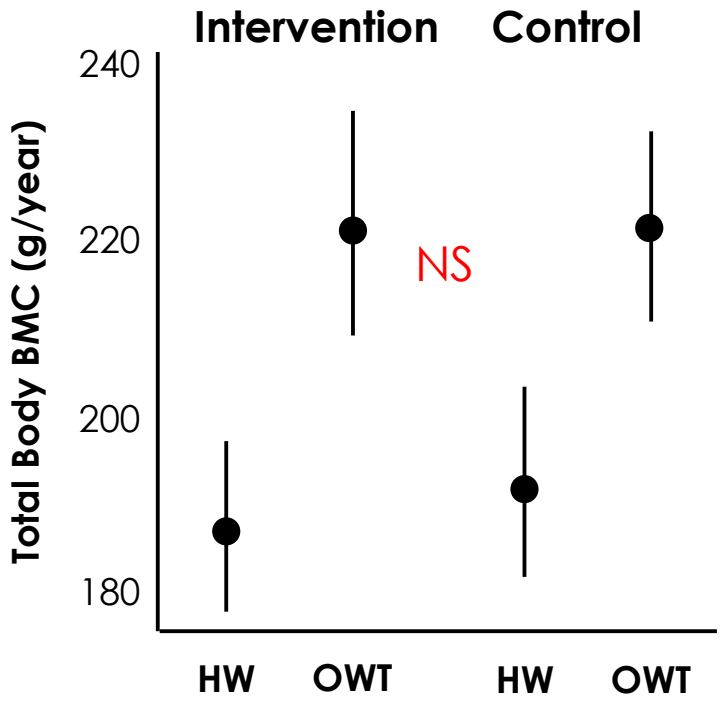
Hill et al J Clin Endocrinol Metab, 2011

Dairy and Bone: Does Obesity Matter?

- 181 healthy boys and girls ages 8-16 years
- 50% overweight/obese (BMI >85th%) and 50% healthy weight (BMI = 5th to 70th%)
- Low baseline calcium consumption: <800 mg/day
- 18-months dairy intervention (3 servings of dairy/day) or regular self-selected intake (control)

Results

- Calcium consumption:
  - Dairy = 1500 mg/day
  - Control = 1000 mg/day
- Dairy had no effect on BMC (total body, spine, hip, forearm)



Vogel et al Am J Clin Nutr, 2017

Vogel et al: Null Effect of Dairy on Bone Mass

1. Self-reported diet
   - Baseline calcium consumption
   - Calcium consumption during intervention

2. Free-living conditions
   - Intervention compliance

3. The timing and tempo of bone growth are dependent upon:
   - Age, sex, population ancestry, sexual maturation, body weight status
   - Bone mass is a "moving target"

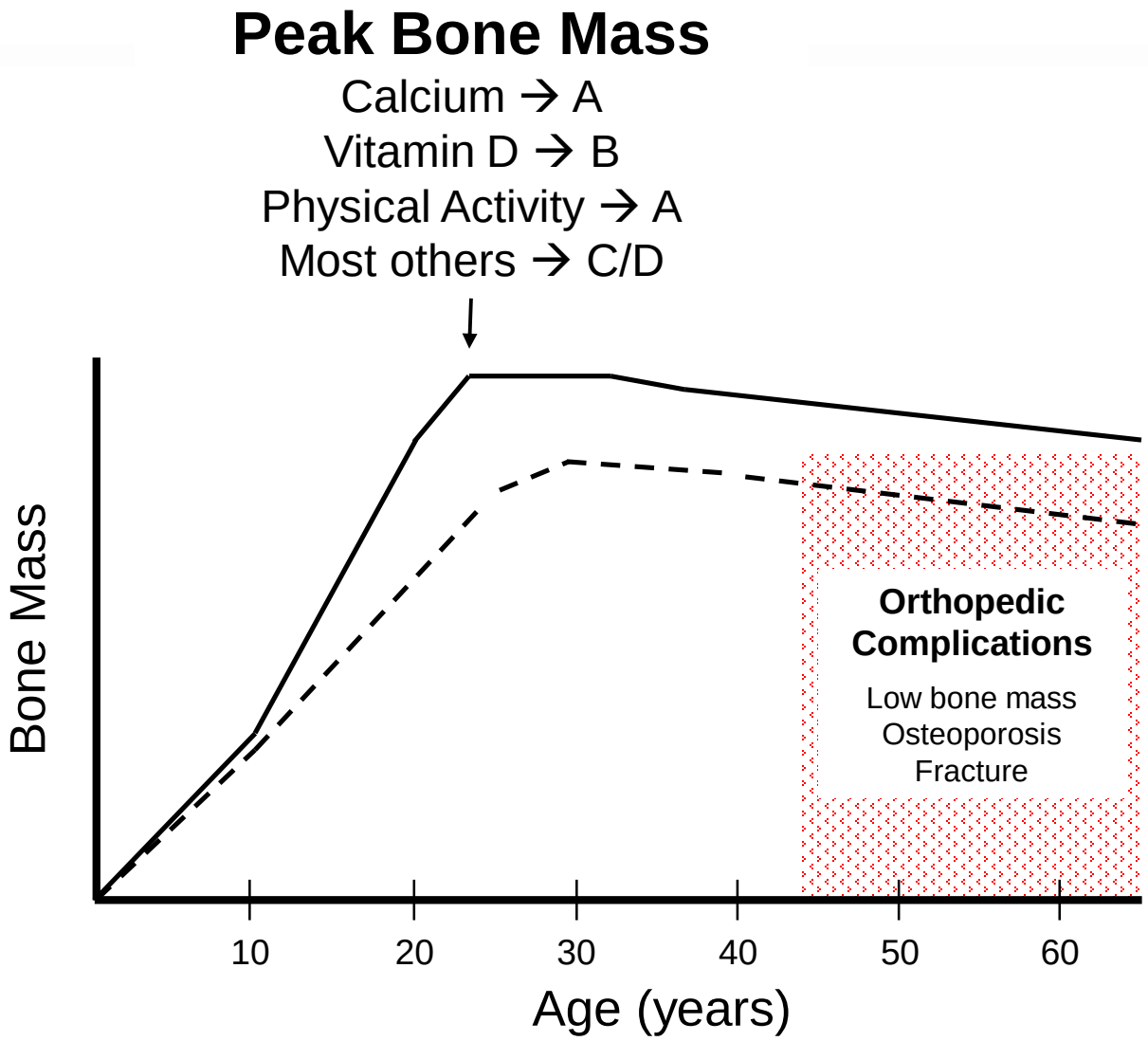
NOF Position on Dairy and Peak Bone Mass

National Osteoporosis Foundation "Peak Bone Mass" Consensus Paper

Benefit of dairy on bone health in children = **B**

Weaver et al Osteoporos Int, 2016

Determinants of Peak Bone Mass



Weaver et al Osteoporos Int, 2016

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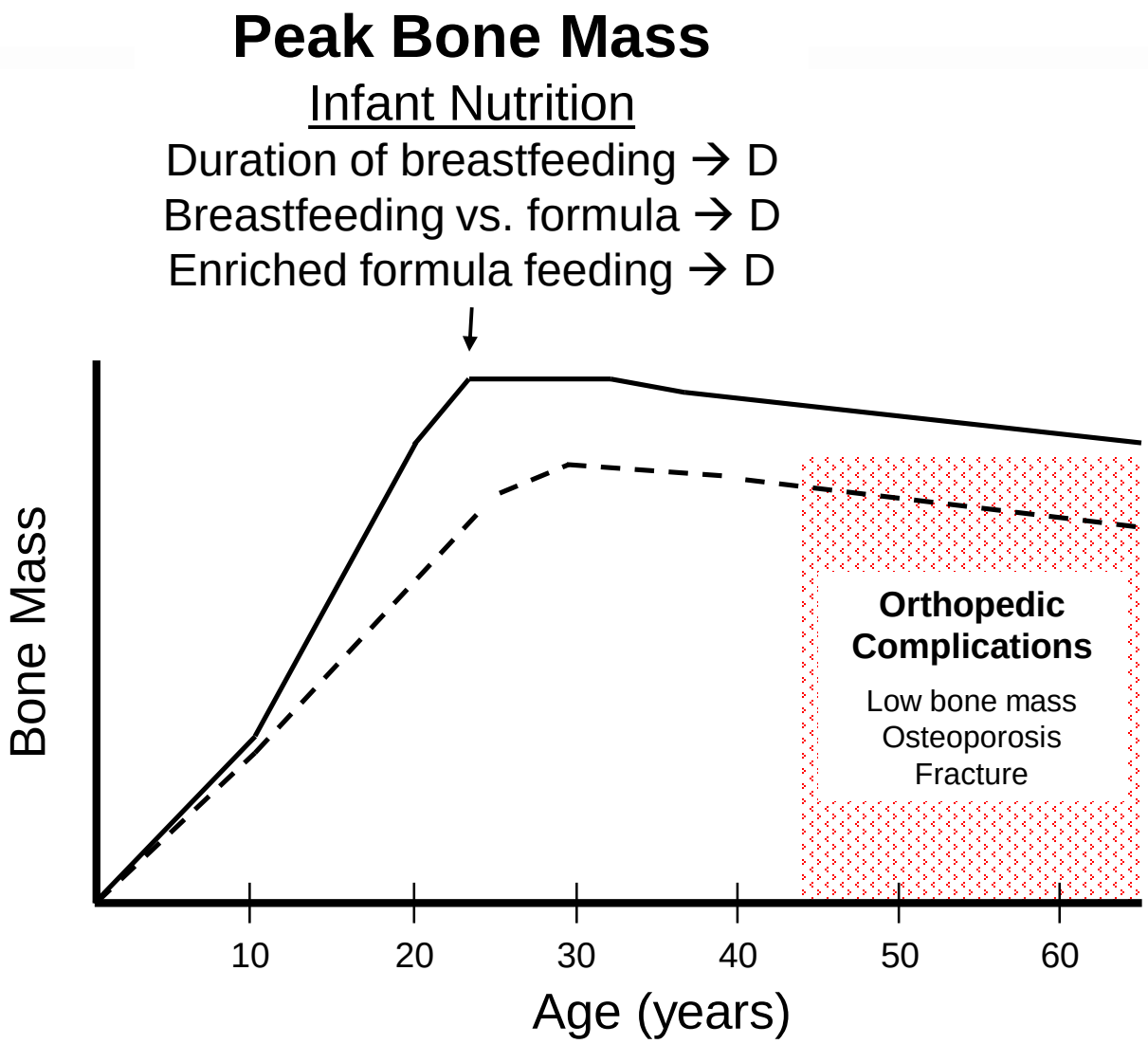
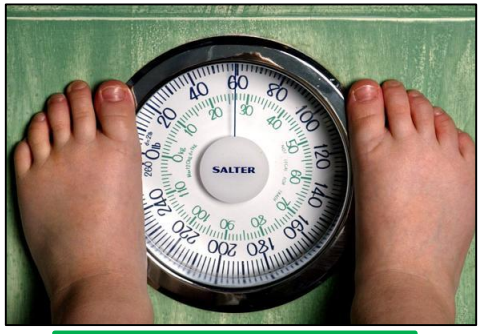


Weaver et al Osteoporos Int, 2016

Why Dairy?

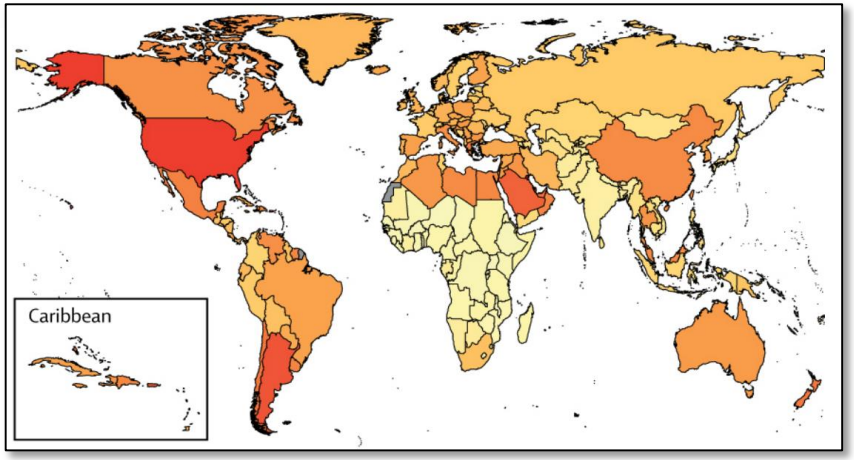
Bone Health



Obesity

Pediatric Obesity: A Major Cause for Concern

- **Pediatric obesity is a global concern**
  - USA: 1/3 are overweight/obese
  - Globally: >100 million obese children
- **Contributors to pediatric obesity**
  - Genetics
  - Physical inactivity
  - Poor diet quality
  - *Among many others…*



Obesity prevalence in boys ages 5-19 years
(darker colors represent greater prevalence)

Ramifications of Obesity

Cardiovascular disease
Hypertension
Pre-diabetes
Type-2 diabetes
Sleep apnea

Is Dairy Anti-Obesigenic?

Displace high calorie drinks

Satiety

Ca modulates fat metabolism

Ca reduces fat absorption

Is Dairy Anti-Obesigenic?

Annals of Epidemiology 26 (2016) 870–882

Contents lists available at ScienceDirect

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

Review article

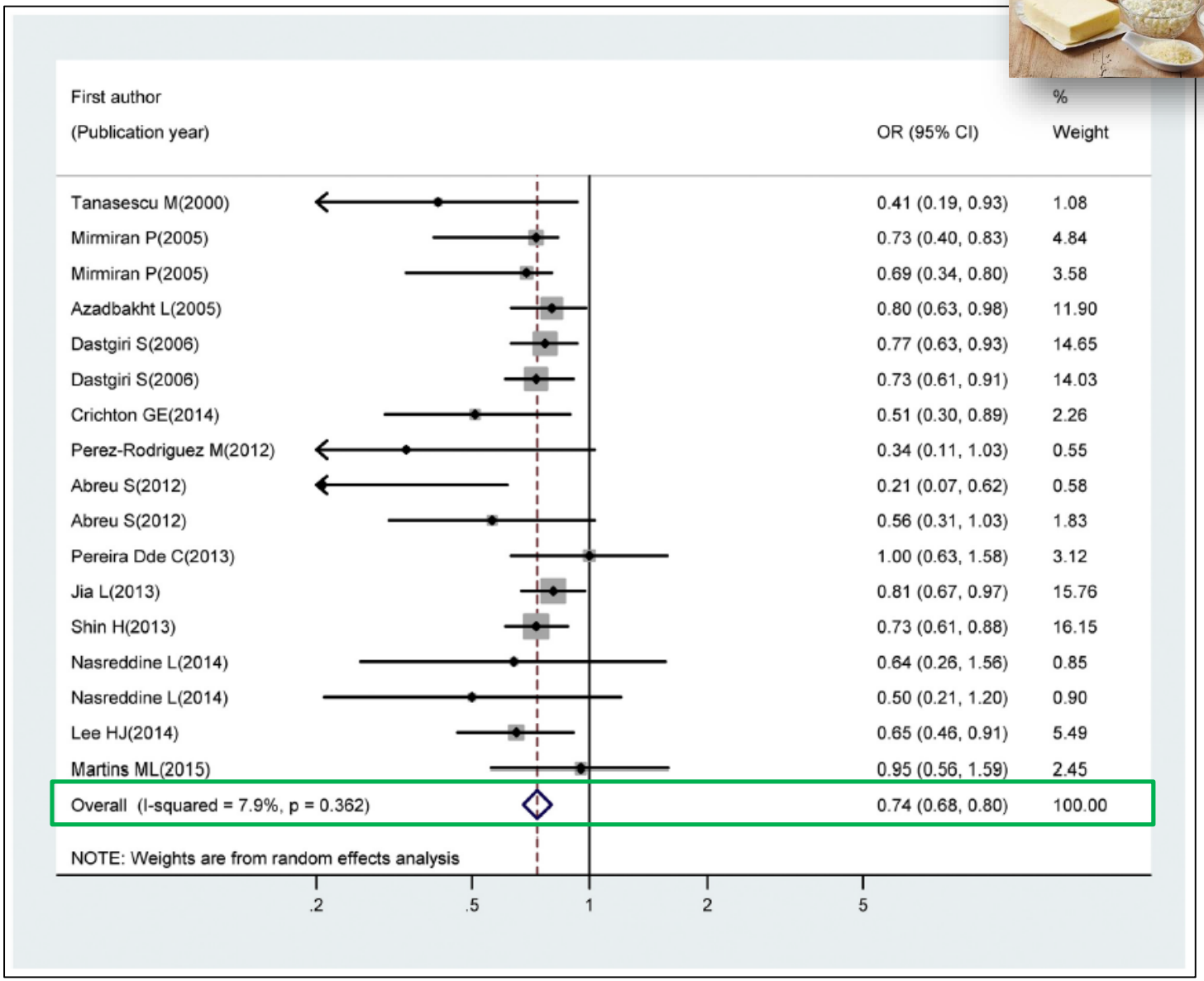
Association of dairy products consumption with risk of obesity in children and adults: a meta-analysis of mainly cross-sectional studies

Weijing Wang MD, Yili Wu MD, Dongfeng Zhang MD *

Department of Epidemiology and Health Statistics, The Medical College of Qingdao University, Qingdao, Shandong, People's Republic of China

Wang et al Annals of Epidemiology, 2016

Dairy and Obesity



Major Limitation…

Most studies examining the link between dairy and obesity are observational

The American Journal of
CLINICAL NUTRITION

Randomized Controlled Trials:
Dairy and Adiposity

The effect of dairy intake on bone mass and body composition in early pubertal girls and boys: a randomized controlled trial[1,2]

*Kara A Vogel,[3] Berdine R Martin,[3] Linda D McCabe,[3] Munro Peacock,[5] Stuart J Warden,[6] George P McCabe,[4] and Connie M Weaver[3]**

The effect of increasing dairy calcium intake of adolescent girls on changes in body fat and weight[1]

Joan M Lappe,[2,3] Donald J McMahon,[5] Ann Laughlin,[3] Corrine Hanson,[4] Jean Claude Desmangles,[2] Margaret Begley,[2] and Misty Schwartz[3]*

No effect of dairy on weight gain or adiposity, regardless of body weight status

Summary
Dairy and Child Health

Summary

Bone Health	***Obesity***
Cross-sectional, prospective, and intervention studies support a positive influence of dairy on bone growth **NOF Consensus: B**	Observational (cross-sectional and prospective) studies suggest that dairy <u>is protective</u> from obesity Intervention studies <u>do not</u> support these observational findings

Dairy and Child Health
Gaps in Knowledge

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1. **Correlation is not causation**
   - Observational studies → causal inference is inappropriate
   - Randomized trials are lacking

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2. **Dairy consumption and obesity-related chronic disease**
   - Type 2 diabetes
   - Cardiovascular disease
   - Hypertension

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3. **Infant nutrition and peak bone mass acquisition**

Questions?