

DAIRY MATRIX AND HEALTH FROM A HOLISTIC POINT OF VIEW

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point of view – Berlin 02-11-2019

WE EAT FOODS NOT NUTRIENTS

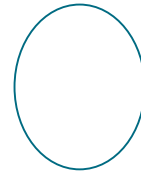
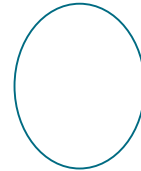
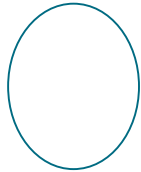
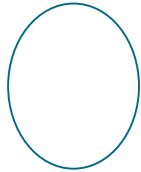
THE SUM OF

PROTEINS

+ CALCIUM

+ FATS

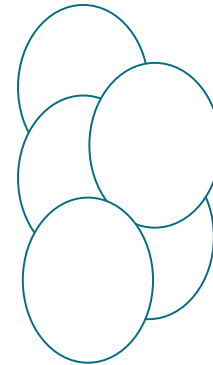
+ VITAMINS



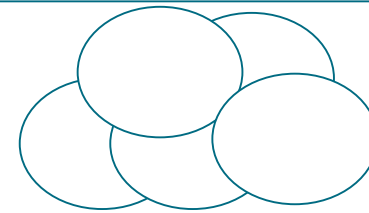
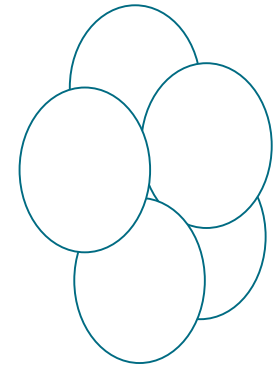
IS DIFFERENT
FROM

FOODS SUCH AS

DAIRY PRODUCTS



WHOLE GRAINS



VIRGIN OILS



WHY ?

IN FOODS

- **NUTRIENTS**

- **ARE INTRICATED TOGETHER**

 - PROTEINS + MINERALS**

- **ARE ASSOCIATED WITH OTHER COMPONENTS**

 - IN FERMENTED DAIRY – *PROBIOTICS***

 - IN PLANT FOODS – *POLYPHENOLS***

- **HAVE AN OTHER BIOAVAILABILITY**

 - CALCIUM + LACTOSE ↗**

 - ZINC/IRON + PROTEINS ↗**

 - PHYTATES + MINERAL ↘**

 - OXALATES + CALCIUM ↘**

 - FATTY ACIDS + CALCIUM ↘**

INTERACTION

BIOAVAILABILITY

FOOD STRUCTURE

COMPLEXITY



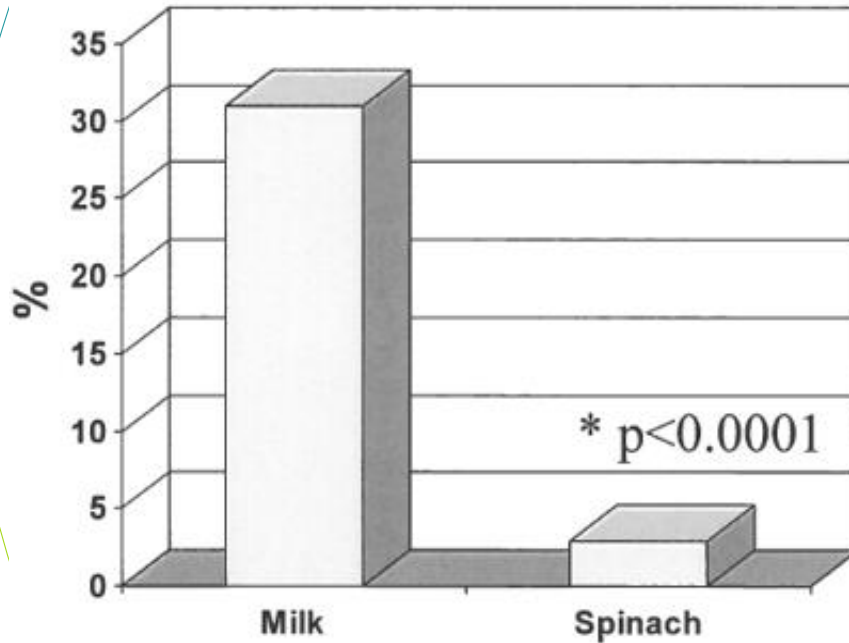
An example of matrix effect

Calcium bioavailability



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CALCIUM BIOAVAILABILITY VARIES ACCORDING TO FOOD SOURCES



Nickel et al. J Nutr 126:1406, 1996
Weaver and Heaney Calcif Tissue Int. 49:244, 1991

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BIOAVAILABILITY OF DIETARY CALCIUM

		Calcium Content (mg)	Absorption Coefficient (%)	Absorbed Calcium (mg)
	250 ml milk	300	32	90
	550g kale	300	32	90
	150g spinach	300	< 5	15

Gueguen L.



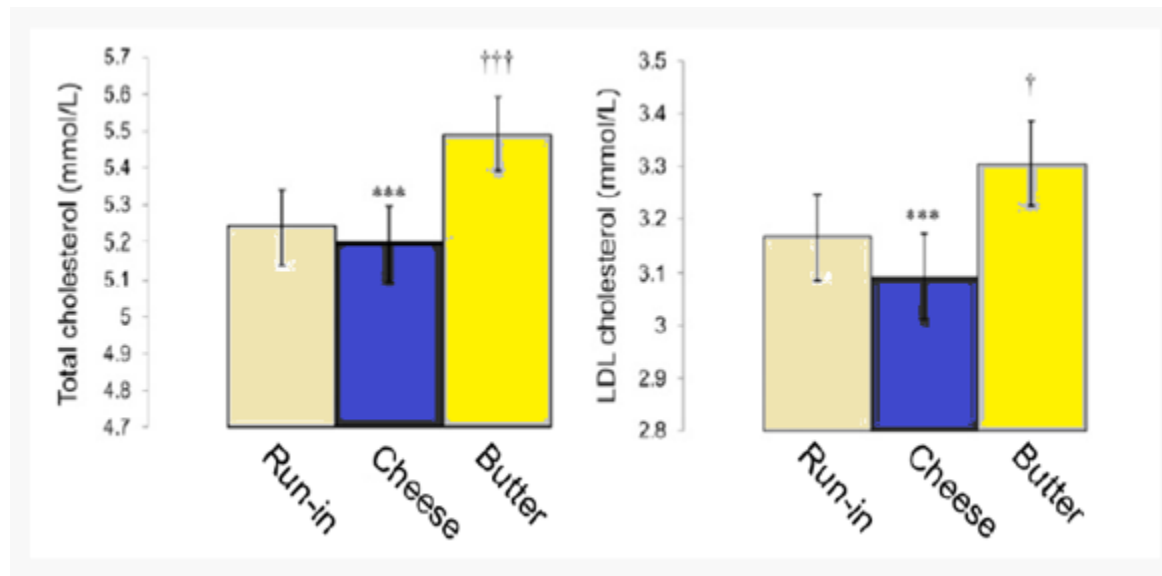
An example of matrix effect

Effect of saturated fatty acids from different dietary sources



THE FOOD MATRIX MODULATES THE EFFECT OF SFA

Changes in total and LDL cholesterol after consumption of ~80 g/d fat (~36g SFA) for 6 weeks as cheese or butter



Cheese vs butter *** $P < 0.0001$, [†]††Significantly different from run-in period: [†] $P < 0.05$, ^{†††} $P < 0.0005$.



Hjerpsted J et al Am J Clin Nutr 2011;94 : 1479-84

HIGH CALCIUM INTAKE INDUCES EXCRETION OF FAT AND DECREASES LDL-C

3 diets with the same amount of calories, fat and SFA

- control non dairy (Ca=500mg/d
- milk and cheese (Ca=1700mg/d)

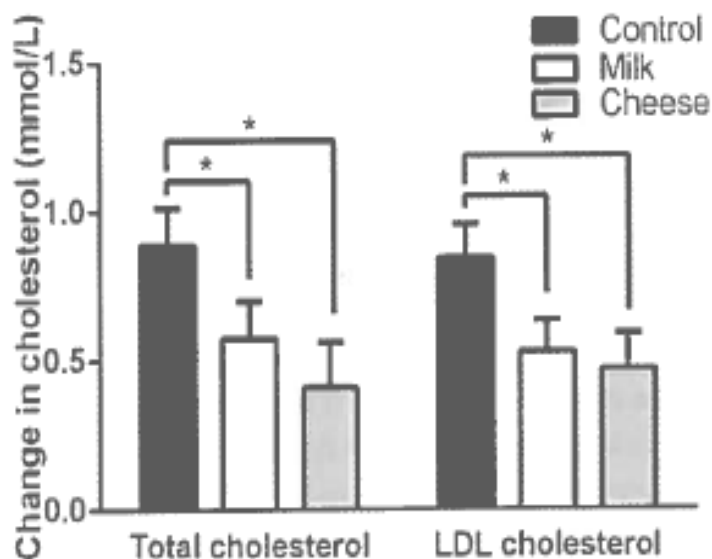


FIGURE 1. Mean \pm SD changes in total and LDL cholesterol after 2-wk consumption of control, milk, and cheese diets. *Total and LDL cholesterol after both milk and cheese diets differed from after the control diet in an ANOVA adjusted for the corresponding baseline variable, diet, and period ($P < 0.05$) ($n = 15$).

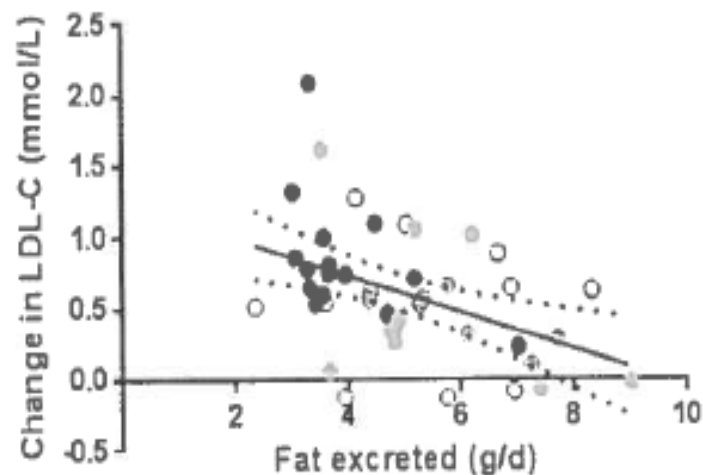
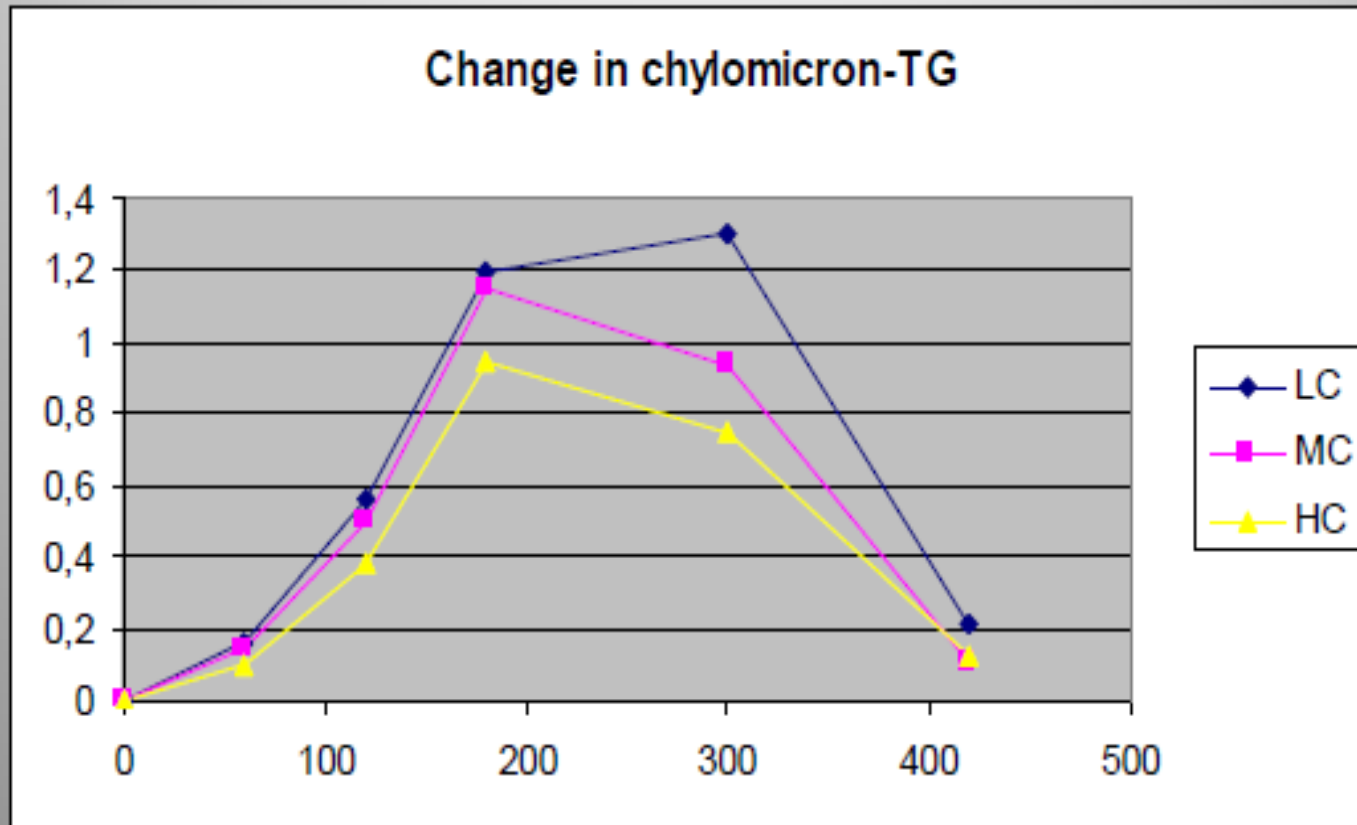


FIGURE 2. Correlations (95% CIs) between changes in LDL-C and fecal fat excretion during the control (black), milk (open), and cheese (gray) periods ($R^2 = 0.163$, $P = 0.002$) ($n = 15$). LDL-C, LDL cholesterol.

Dairy Calcium reduces fat absorption



Lorenzen JK, Astrup A. *Am. J. Clin. Nutr.* (2007)

n=13



An example of matrix effect

Dairy and CHD



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THE ASSOCIATION BETWEEN DIETARY SATURATED FATTY ACIDS AND CARDIOVASCULAR DISEASE DEPENDS ON THE SOURCE

MULTI-ETHNIC STUDY OF ATHEROSCLEROSIS

5209 ♀

45-84 YEARS

FOLLOW-UP

2000-2010

MEAT FAT

+5g/d

+5% of energy

+48%

+26%

DAIRY FAT

+5g/d

+5% of energy

-21%

-38%

CVD RISK



de Oliveira Otto MC et al AJCN
2012, 96, 397-404

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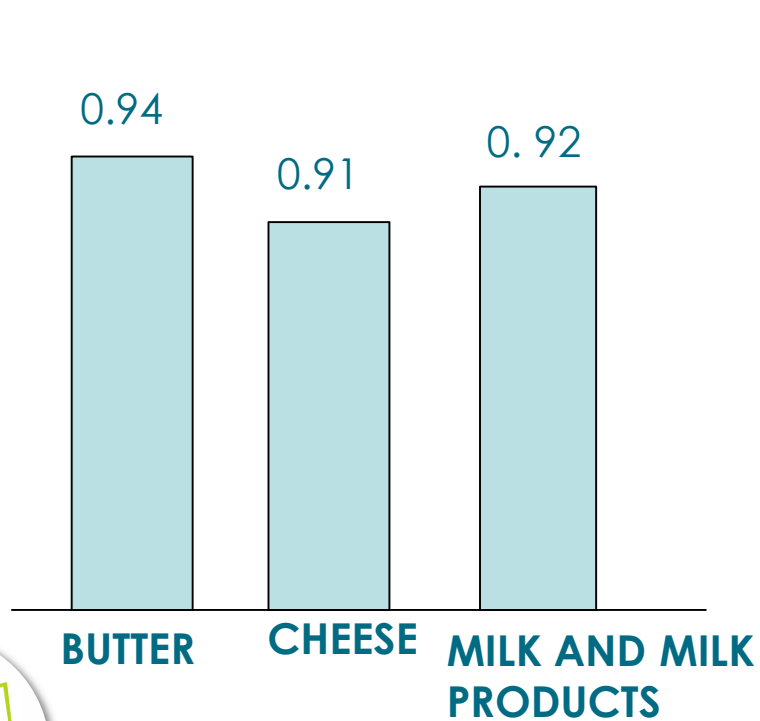
THE ASSOCIATION BETWEEN DIETARY SATURATED FATTY ACIDS AND ISCHEMIC HEART DISEASE DEPENDS ON THE SOURCE

THE EPIC – NETHERLANDS COHORT

35 597 SUBJECTS

FOLLOW-UP 12 YEARS

RISK OF
IHD



ROLE OF C4:0
C10:0
C15:0
C17:0
C14:0

NO SIGNIFICANT
ASSOCIATION WITH
SFA FROM MEAT

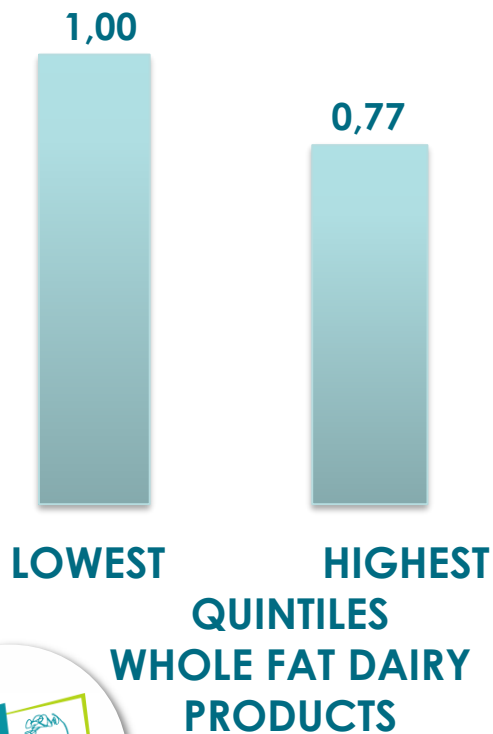


Praagman J et al. AJCN 2016, 103, 356-65

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SOURCE OF FATTY ACID AND RISK OF TYPE 2 DIABETES

**MALMO DIET
AND CANCER COHORT**
2693 subjects
Follow-up 14 years



WHOLE FAT DAIRY PRODUCTS

→ ↘ risk (-23%)
(p < 0,001)

MEAT FATTY
LEAN



↗ risk
↗ p < 0,04
↗ p < 0,001



AJCN 2015, 101, 1065-80

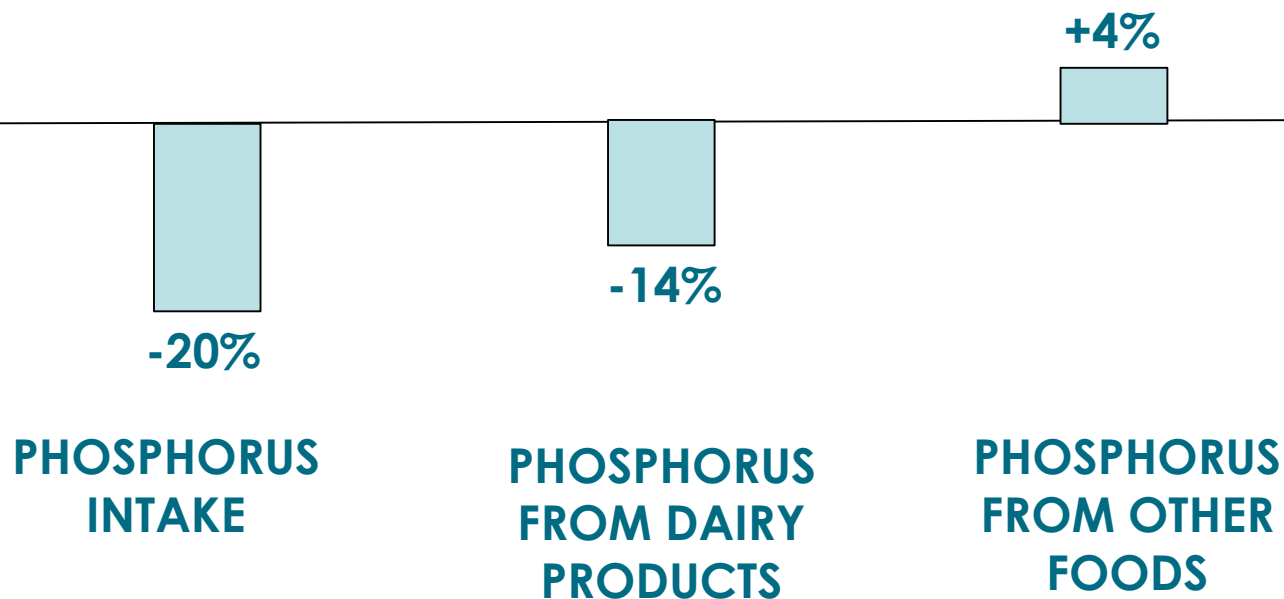
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PHOSPHORUS AND BLOOD PRESSURE

13 444 SUBJECTS } ARIC COHORT
MESA STUDY

6,2 YEARS FOLLOW-UP

RISK OF
HYPERTENSION



HYPERTENSION 2010, 55, 776-784

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An example of matrix effect

dairy and bone health

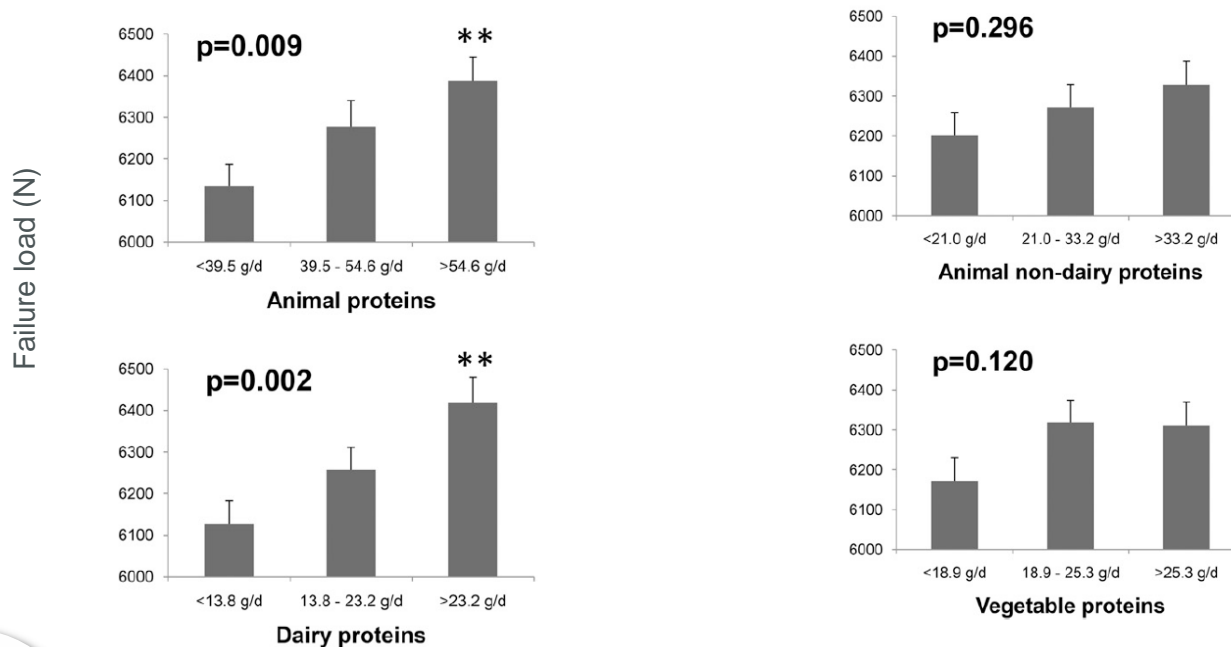


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MATRIX EFFECT AND BONE

Bone microstructure and resistance is significantly associated to dairy protein intake and not to other protein sources

- 746 women; 65 years
- high resolution computerized tomography (distal tibia)



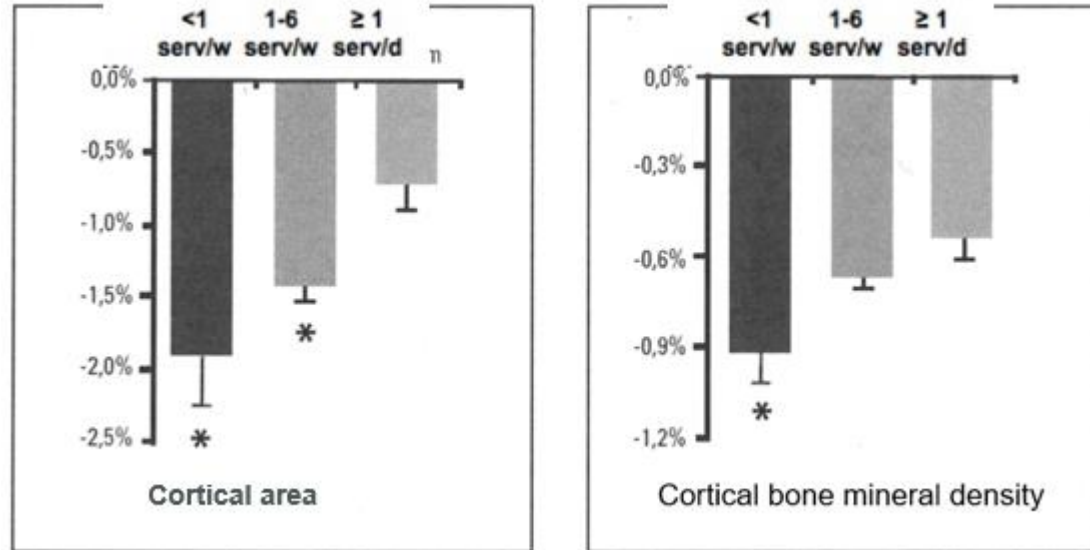
Durosier-Izard C et al. AJCN 2017; 105(2):513-525

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SPECIFIC MATRIX EFFECT OF FERMENTED DAIRY PRODUCTS

Bone loss is significantly less when yogurt intake is > 1/d independantly of calcium, proteins and energy intake

- 482 post menopausal ♀
- Follow-up $3 \pm 0,5$ years



Biver E et al. Osteoporos. Int. 2018, 29, (8), 1771-82

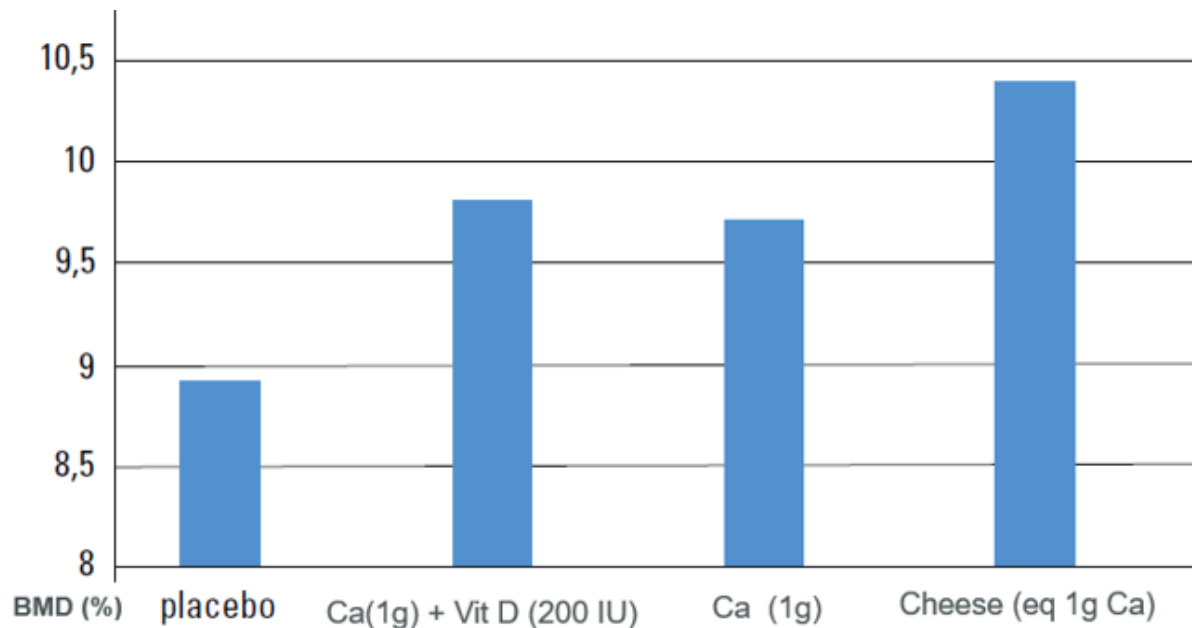
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MATRIX EFFECT OF DAIRY PRODUCTS ON THE BONE

Cheese is more efficient than calcium supplementation for bone mass accrual

195 girls 10-12 years; 2 years trial

- Placebo
- 1g calcium
- 1g calcium + 200 ui Vit. D
- Cheese (-> 1 g calcium)



Chen S et al. AJCN 2005, 82, (5), 1115-26

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THE MATRIX EFFECT: THE METABOLIC PROVE

- 12 healthy post menopausal women
- Randomized cross-over trial 2x6 weeks

4 servings /d milk and yogurt
or same amount of Ca and Vit D
from supplements

**METABOLISM
WITH ⁴¹Ca tracer**

**-BONE RESORPTION DECREASED IN BOTH PERIODS
-BONE FORMATION SIGNIFICANTLY INCREASED
IN THE DAIRY PERIOD ONLY (p = 0,03)
despite a lower calcium intake (-120 mg)**



Demmer E et al .FASEB J. 2014, 28 (S1) abstract 1018.12

DAIRY PRODUCTS AND FEMORAL NECK FRACTURES

Nurses' Health Study 80600 women

Health Professionals Study 43306 men

Follow-up 32 years – Every 4 years

	Milk (/ 240ml)	Cheese	Total Dairy Foods
M + W	-8%	-6%	-6%
W	-8%	-9% NS	-7%
M	-9% NS	+4%	-4%

NOT EXPLAINED BY
THE CALCIUM, VIT D
AND PROTEIN
CONTENT OF DAIRY
PRODUCTS
SUGGESTING THE
ROLE OF
INTERACTIONS
WITHIN THE DAIRY
MATRIX

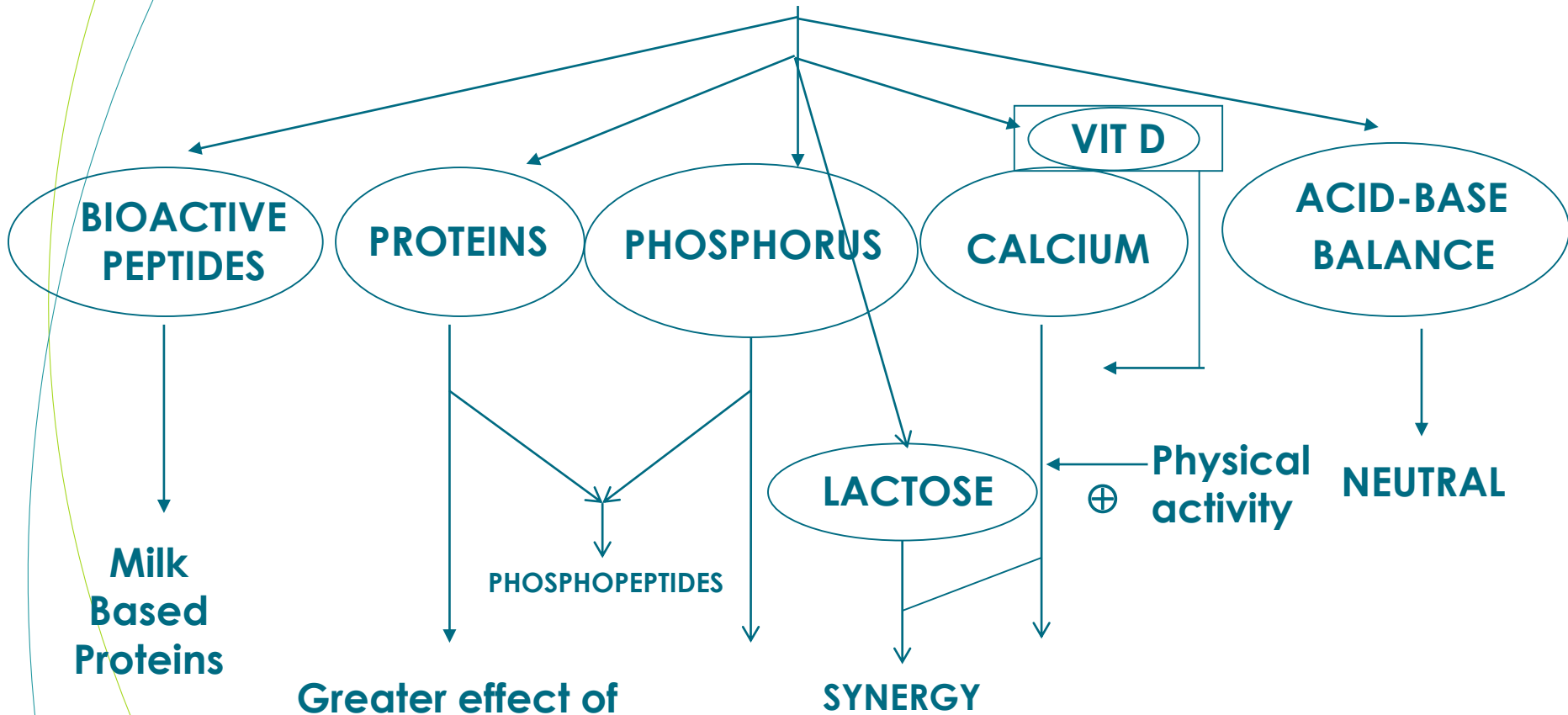


Feskanich D et al. Osteoporos Int 2018, 29, 2, 385-96

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THE MILK MATRIX EFFECT ON BONE

MULTIPLE MECHANISMS OF ACTION



Greater effect of milk / meat on bone turn-over

J Am Coll Nutr 2013, 32 (4) 251-63
Nutr Rev 2005, 63, 361-73
AJCN 2007, 85, 1428-33
EJCN 2007, 61, 957-62



An example of matrix effect

dairy and weight

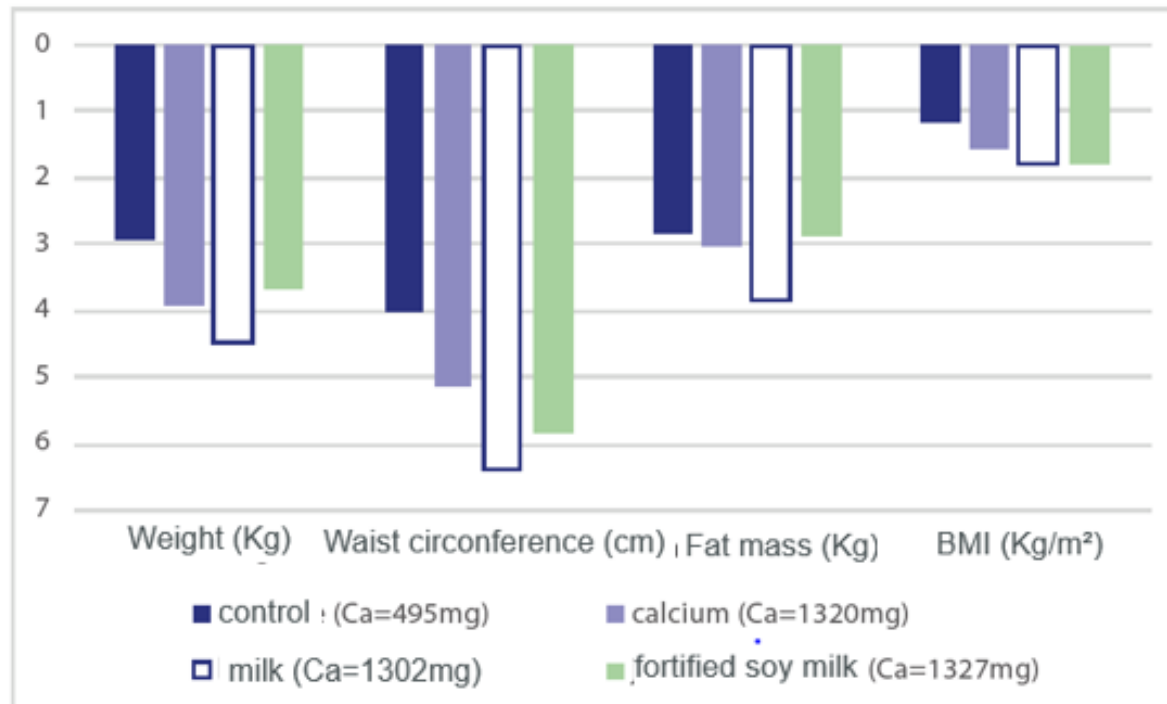


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CALCIUM SOURCES AND WEIGHT LOSS

Clinical Trial: 64 overweight women, 8 weeks

Hypocaloric diet + 1300 mg calcium (from supplement, milk or fortified soy milk)



Faghih SH et al. *Nutr Metab Cardiovasc Dis.* 2011;21: 499-503)

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CALCIUM OR DAIRY FOODS AND BODY COMPOSITION

135 post menopausal overweight or obese women

6 months energy restricted weight loss study

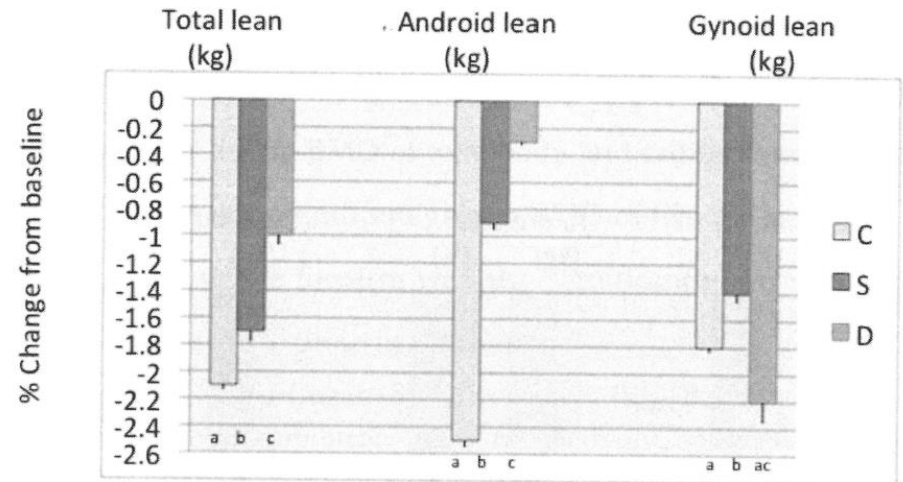
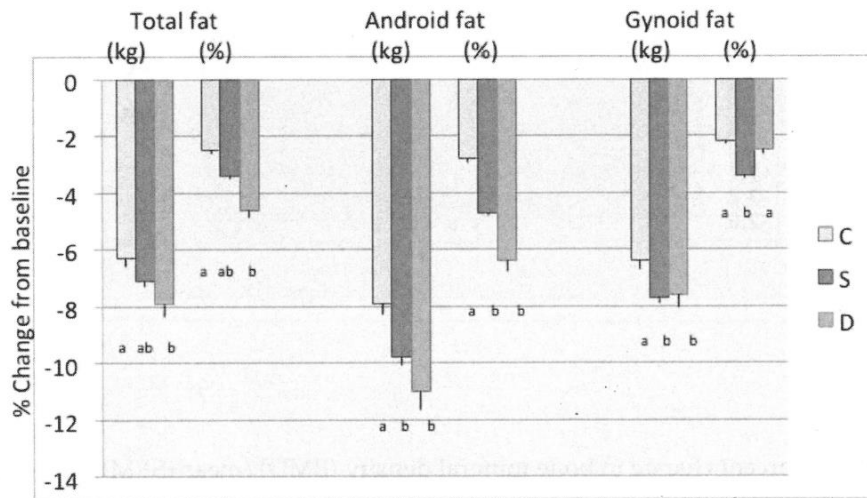
complemented

- low fat dairy foods (D)

- Ca + Vitamin D supplements (S)

- Placebo (C)

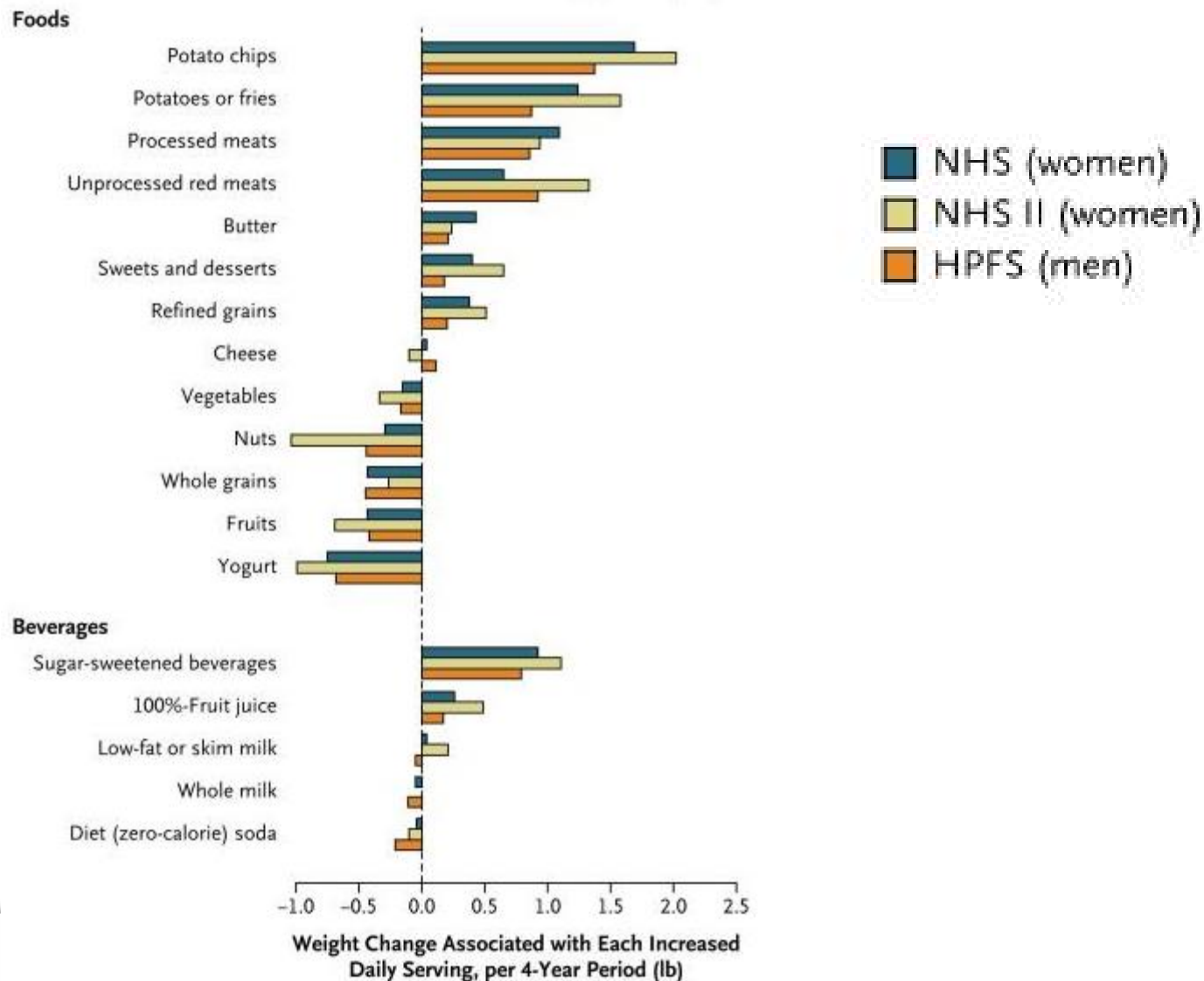
	Kcal	Calcium
	1502	1170
	1368	1672
	1375	712



Nutrients (in press)

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DAIRY PRODUCTS AND WEIGHT CHANGE

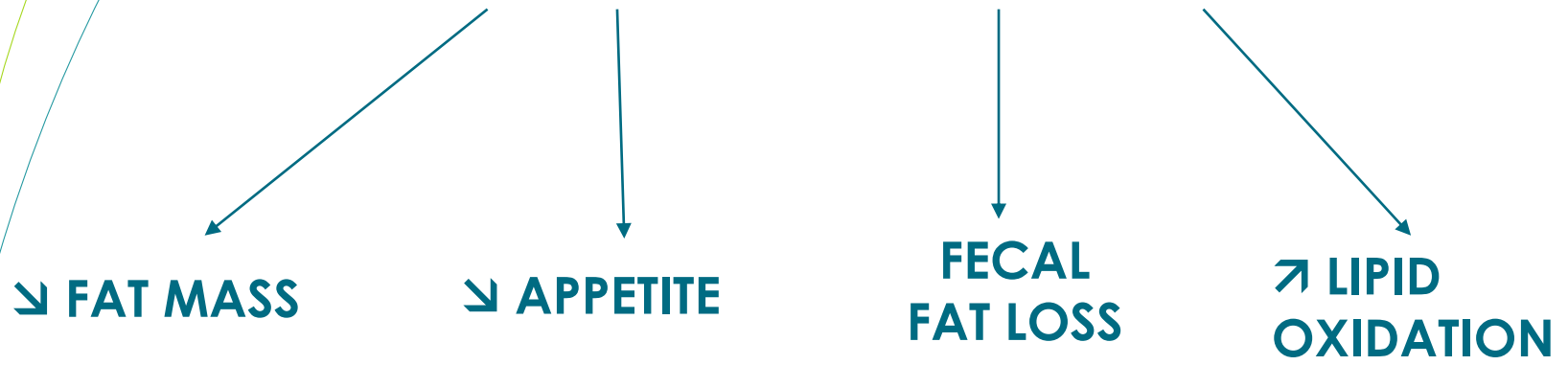


Mozaffarian D et al. NEJM 2011. 364(25): 2392-2404

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DAIRY PRODUCTS AND WEIGHT



MORE ↓ WEIGHT IF CALORIC RESTRICTION

CALCIUM

PROTEINS

CLA and TRANS FA



Br J Nutr 2009, 101, 659-663
Br J Nutr 2011, 105, 133-143
EJCN 2012, 66, 622-7
EJCN 2012, 66, 1104-1109



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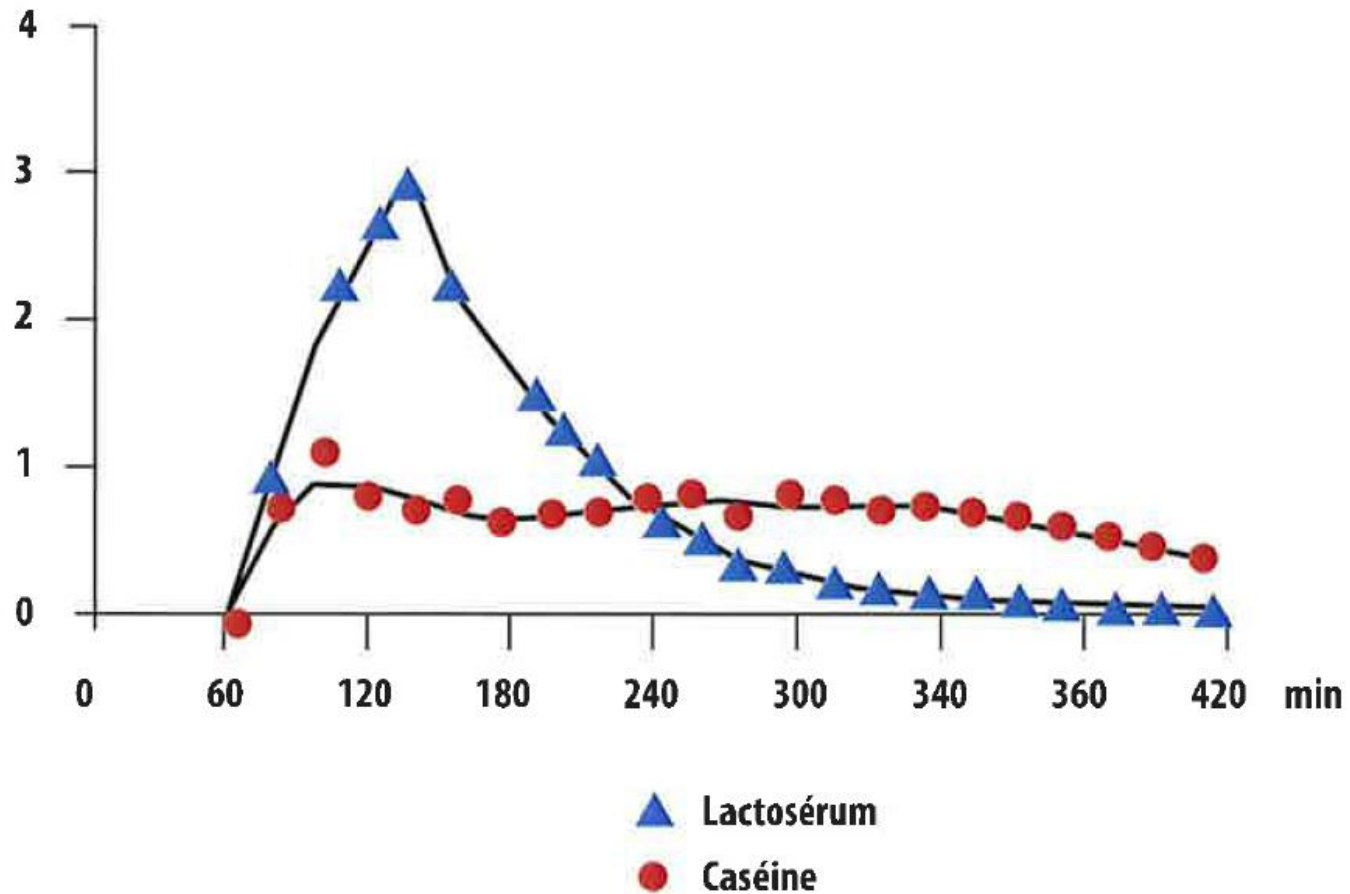
An example of matrix effect

dairy and sarcopenia



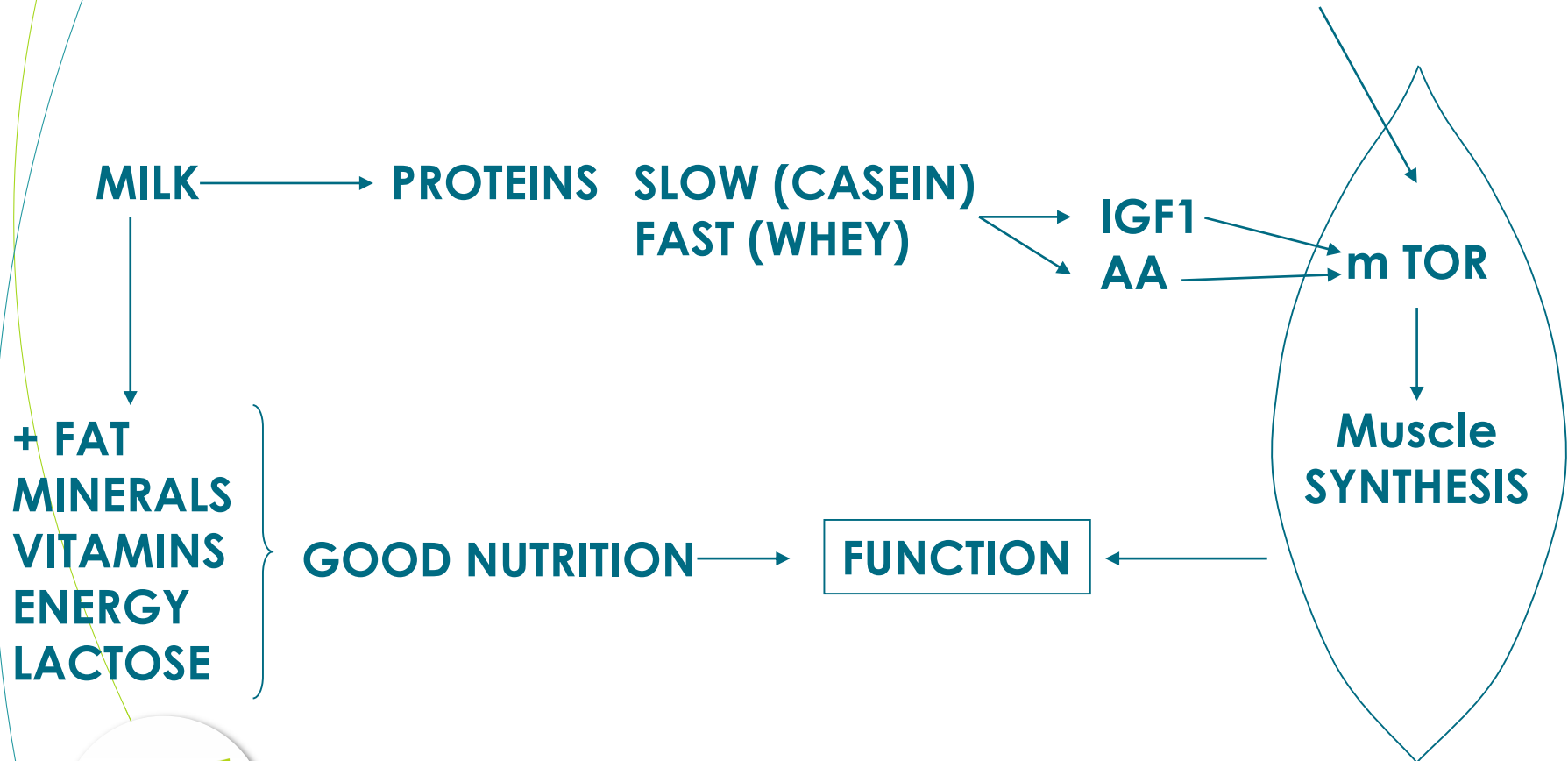
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SLOW AND FAST PROTEINS IN THE SAME FOOD



THE PREVENTION OF SARCOPENIA

MECHANICAL LOADING



J Am Coll Nutr 2013, 32, 251-63

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MORE THAN NUTRIENTS A MULTIFUNCTION FOOD

THE SWISS KNIFE

AN UNIQUE FOOD

MULTIPLE FOODS

MILK
YOGURT
WHITE CHEESE
CREAM CHEESE
FERMENTED CHEESE

MULTIPLE NUTRIENTS

THE RICHEST FOOD
. VARIETY
. QUANTITY

MULTIPLE EFFECTS

BLOOD PRESCURE
WEIGHT
METABOLIC SYNDROME
TYPE 2 DIABETES
CARDIOVASCULAR RISK
BONE
MUSCLE
GROWTH...

MULTIPLES INTERACTIONS : THE « FOOD SYNERGY » OF D.R. JACOBS



AN UNIQUE FOOD



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THE NEW MATRIX EFFECT

NOT ONLY THE SUM OF ITS NUTRIENTS
BUT ALSO THE NEW MATRIX EFFECT

FAVOURABLE INTERACTIONS

EXAMPLES

SARCOPENIA

Proteins
Whey
Casein
Calcium
Vit D

**BONE
METABOLISM**

Vitamin D
Calcium
Phosphorus
IGF1
Proteins

**WEIGHT
CONTROL**

Calcium
Proteins
CLA

**CARDIOVASCULAR
FUNCTION**

Calcium
Fatty acids (CLA)
Probiotics (yogurt)
Bioactive peptides
Vitamin D

**COLORECTAL
CANCER**

Calcium
Probiotics



THE NEW DIETARY PYRAMID

