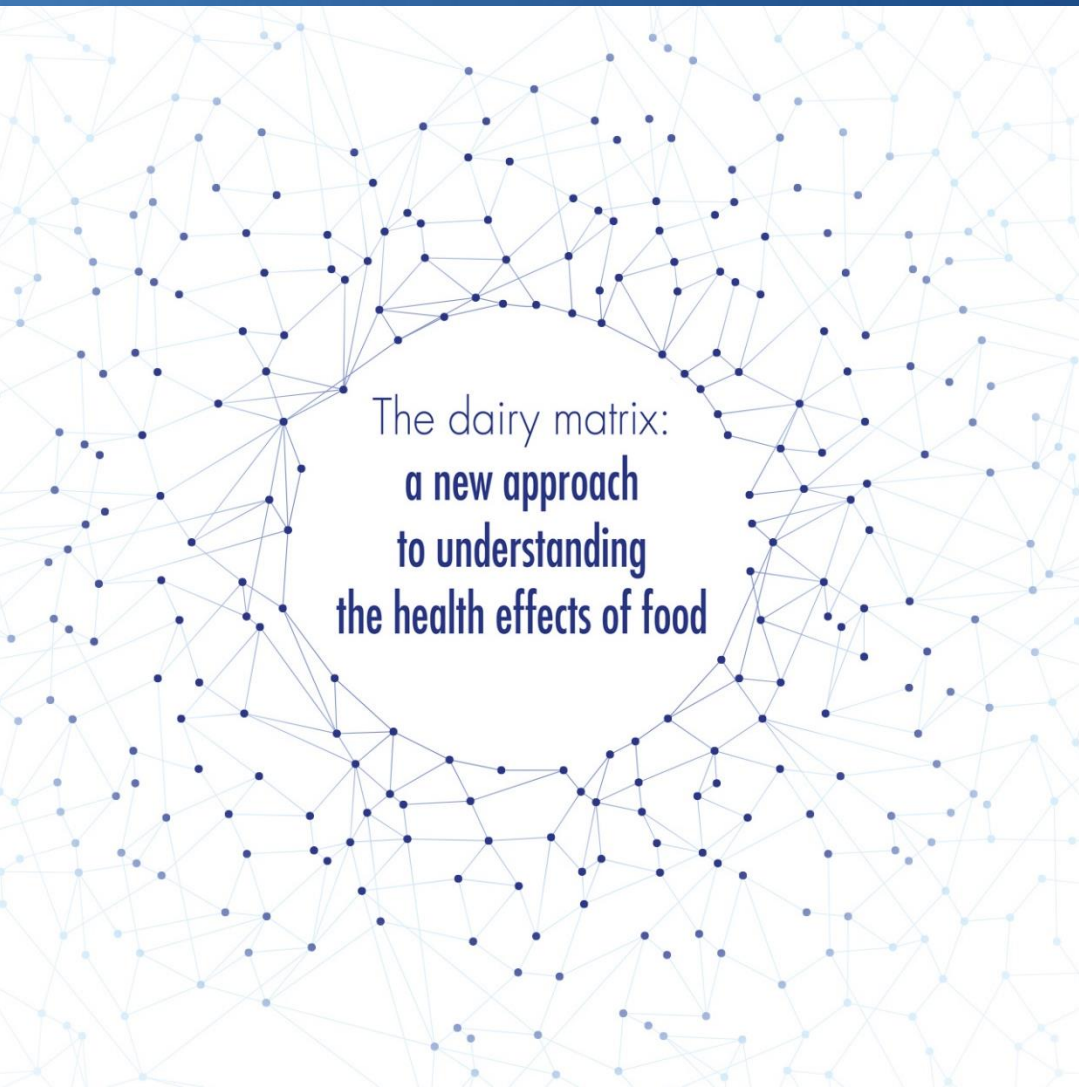


European Milk Forum

Muscle, bones and body fat: the dairy matrix effects on body composition

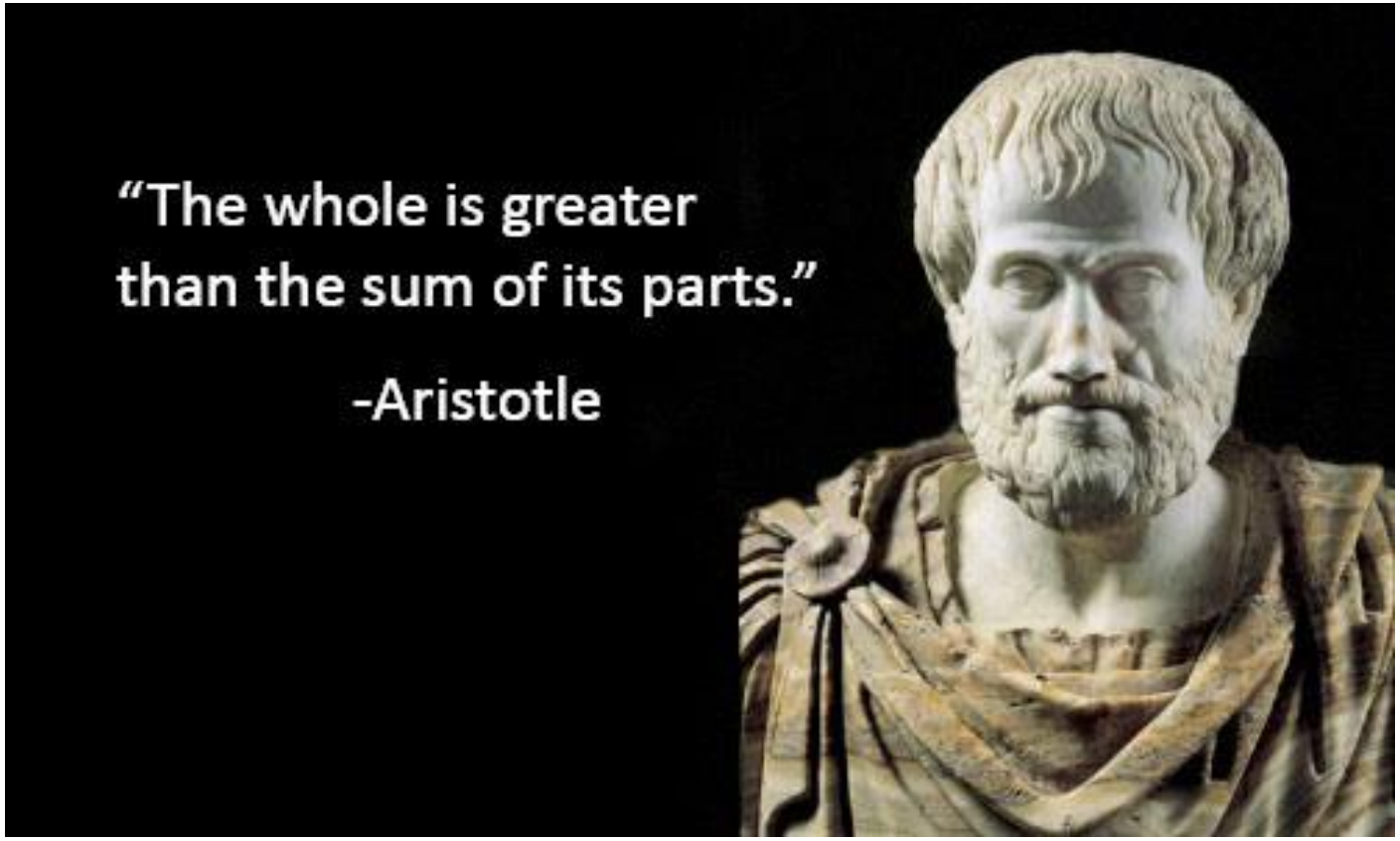
Dr Michelle McKinley
School of Medicine, Dentistry & Biomedical Science,
Institute for Global Food Security,
Queen's University Belfast
m.mckinley@qub.ac.uk

QUEEN'S UNIVERSITY BELFAST

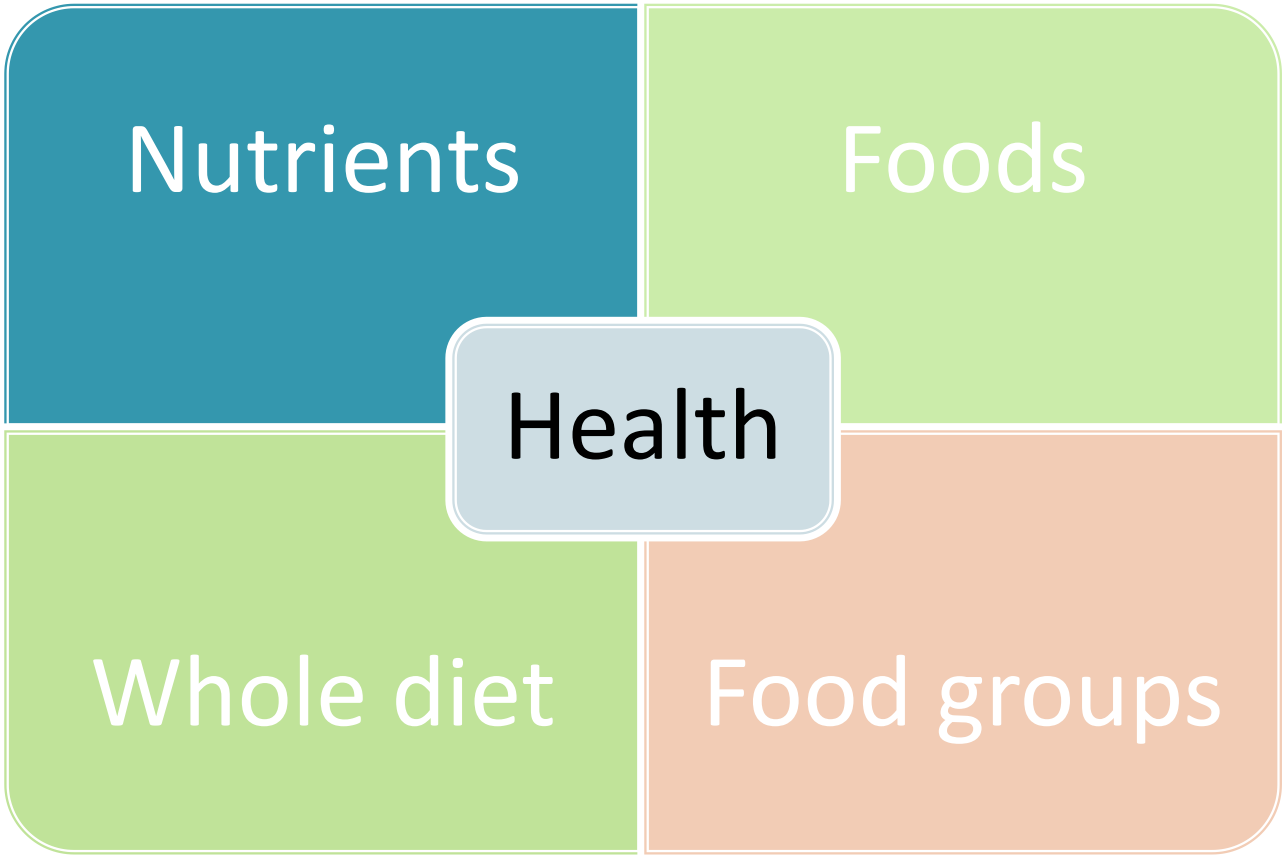
Milk Matrix
milknutritiousbynature.eu

Dairy matrix

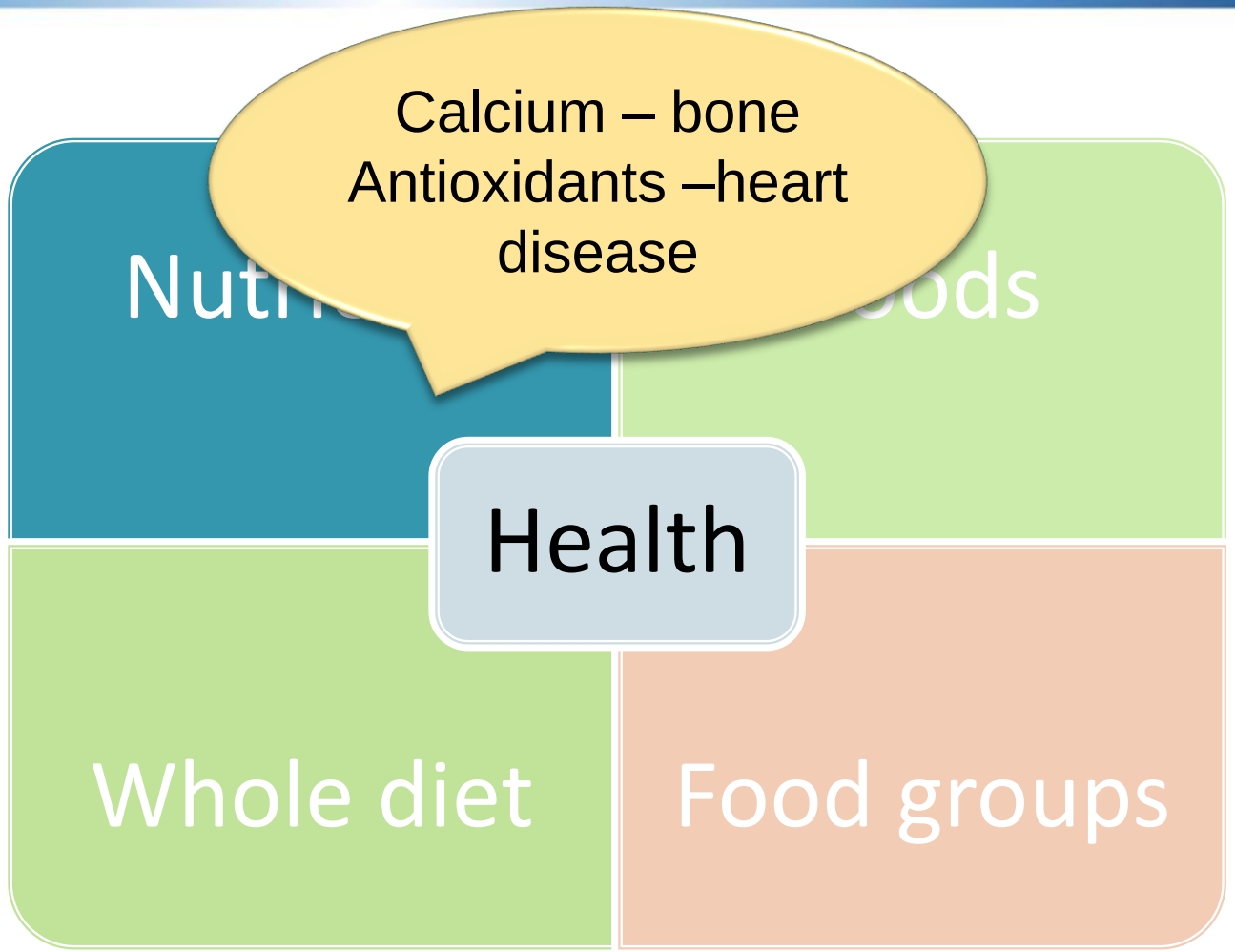
New directions in nutrition



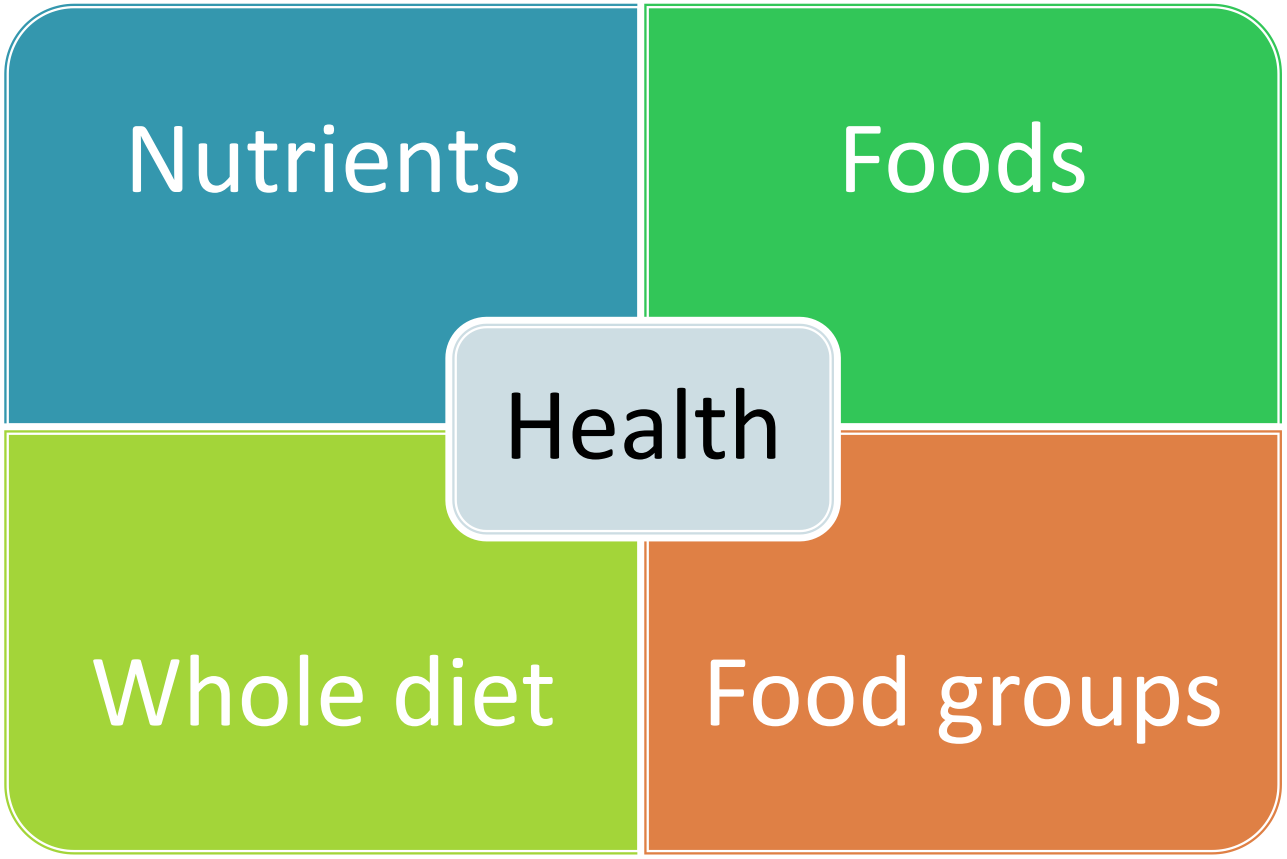
Consider the whole as well as the parts.....



Consider the whole as well as the parts…..



Consider the whole as well as the parts…..



Holistic *Vs* reductionist approaches

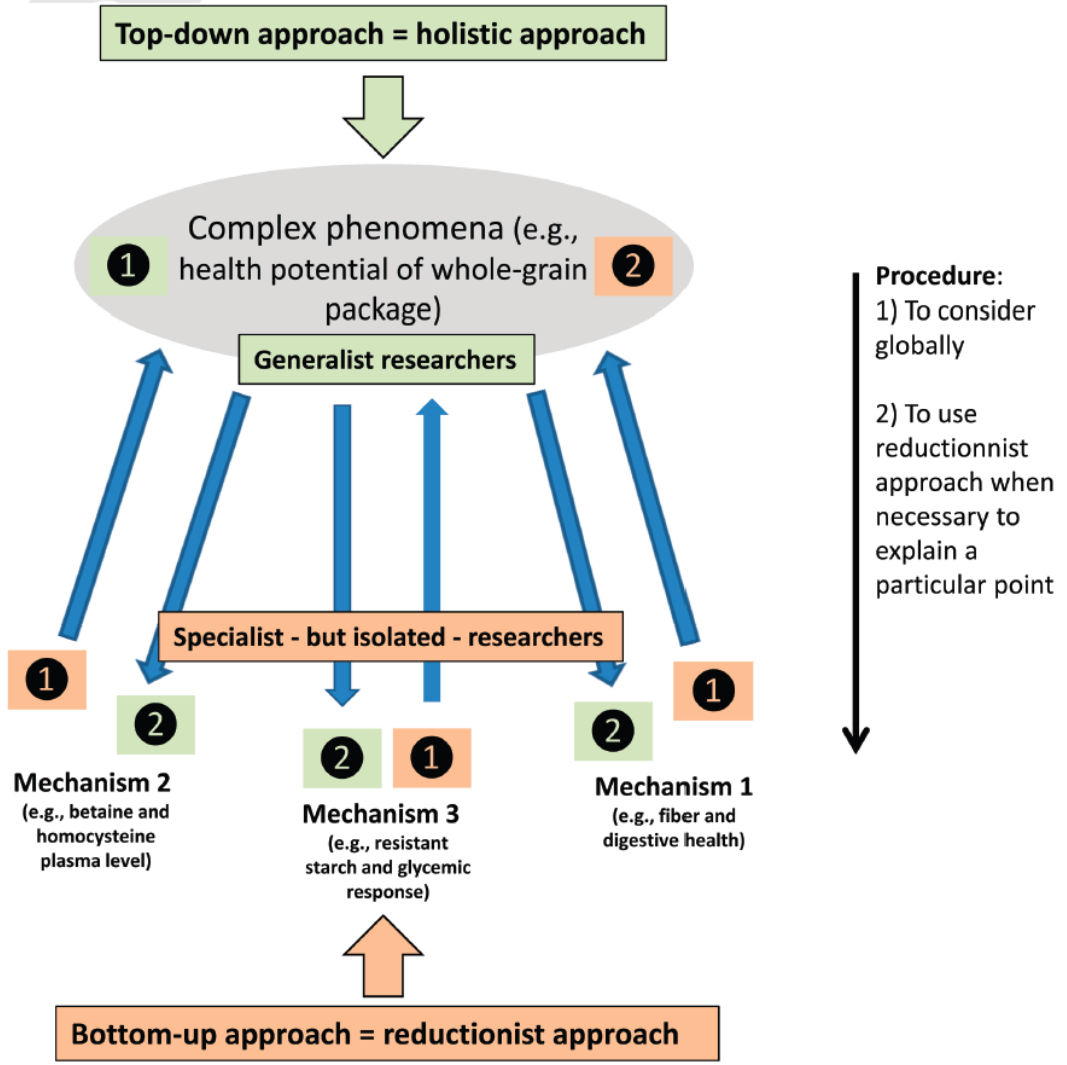


FIGURE 2 The top-down (holistic) compared with bottom-up (reductionist) approaches to research.

Fardet & Rock, Adv Nutr 2014;5:430-446

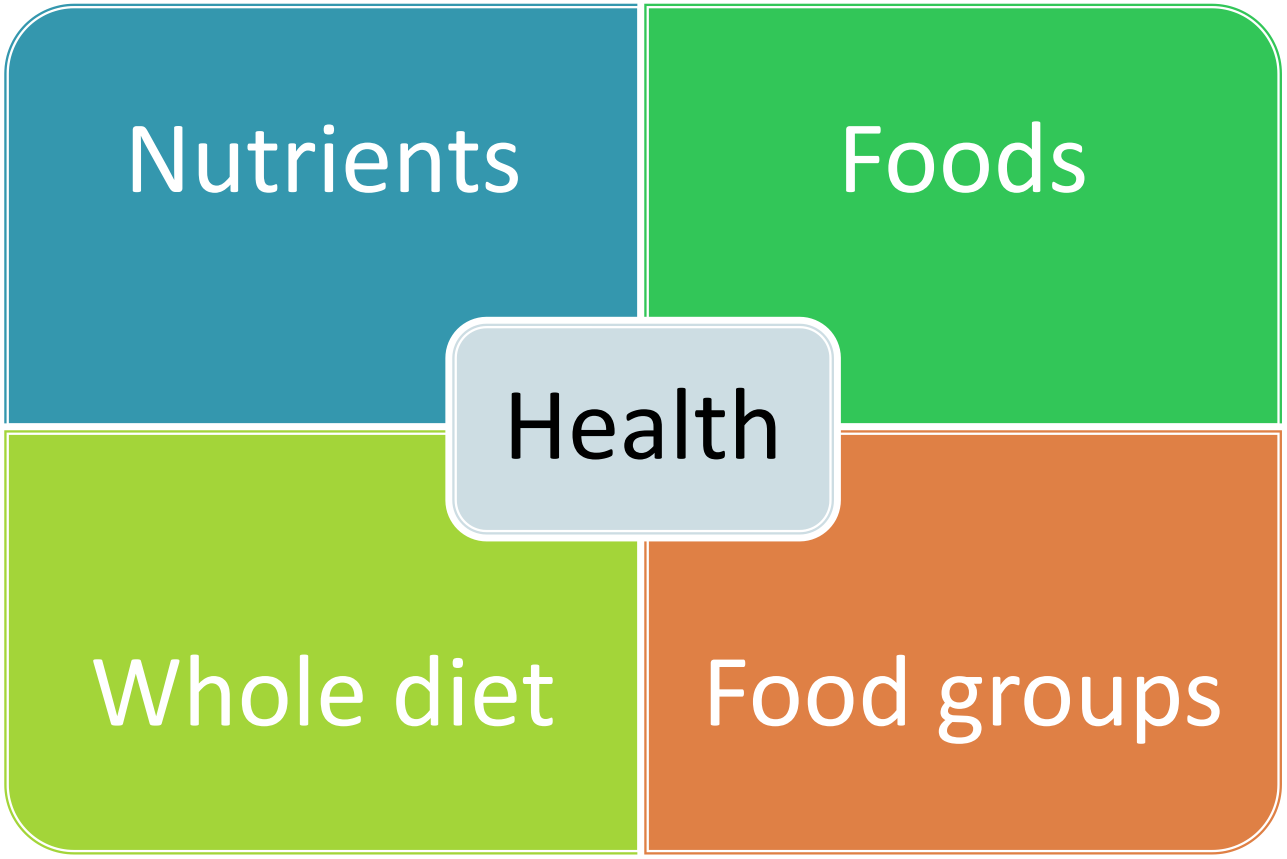
Consider the whole as well as the parts.....

- Reductionist approach:
  - Responsible significant advances in nutrition
  - Possible limitations:
    - Public association of a food with only one nutrient
    - Oversimplification of nutrition – leading to classification of some foods as 'negative' or 'super foods' because of one piece of information
    - Discrepancy between observational and clinical trials

Fardet & Rock, Adv Nutr 2014;5:430-446

- Milk & dairy more than just calcium:
  - High quality protein
  - Bioactive peptides
  - 400 different fatty acids
  - Lactose
  - > 8 Vitamins
  - > 5 Minerals
  - Fermented products with unique composition

Consider the whole as well as the parts…..



The complexity of the dairy matrix

A heterogeneous food group

Milk

- Fat
- Protein

Cheese

- Bacterial cultures
- Ripening/aging
- Fat
- Protein

Yogurt

- Bacterial cultures
- Fat
- Sugar

A heterogeneous food group……

Milk	Cheese	Yogurt
Protein	Protein	Sugar

PLUS
- Variations in physical structure
– liquid, gel, solid……

Studying the effect of the dairy matrix

Weight management

Dairy and weight : systematic review & meta-analysis

International Journal of Obesity (2012) **36,** 1485 - 1493

www.nature.com/ijo

REVIEW

Effect of dairy consumption on weight and body composition in adults: a systematic review and meta-analysis of randomized controlled clinical trials

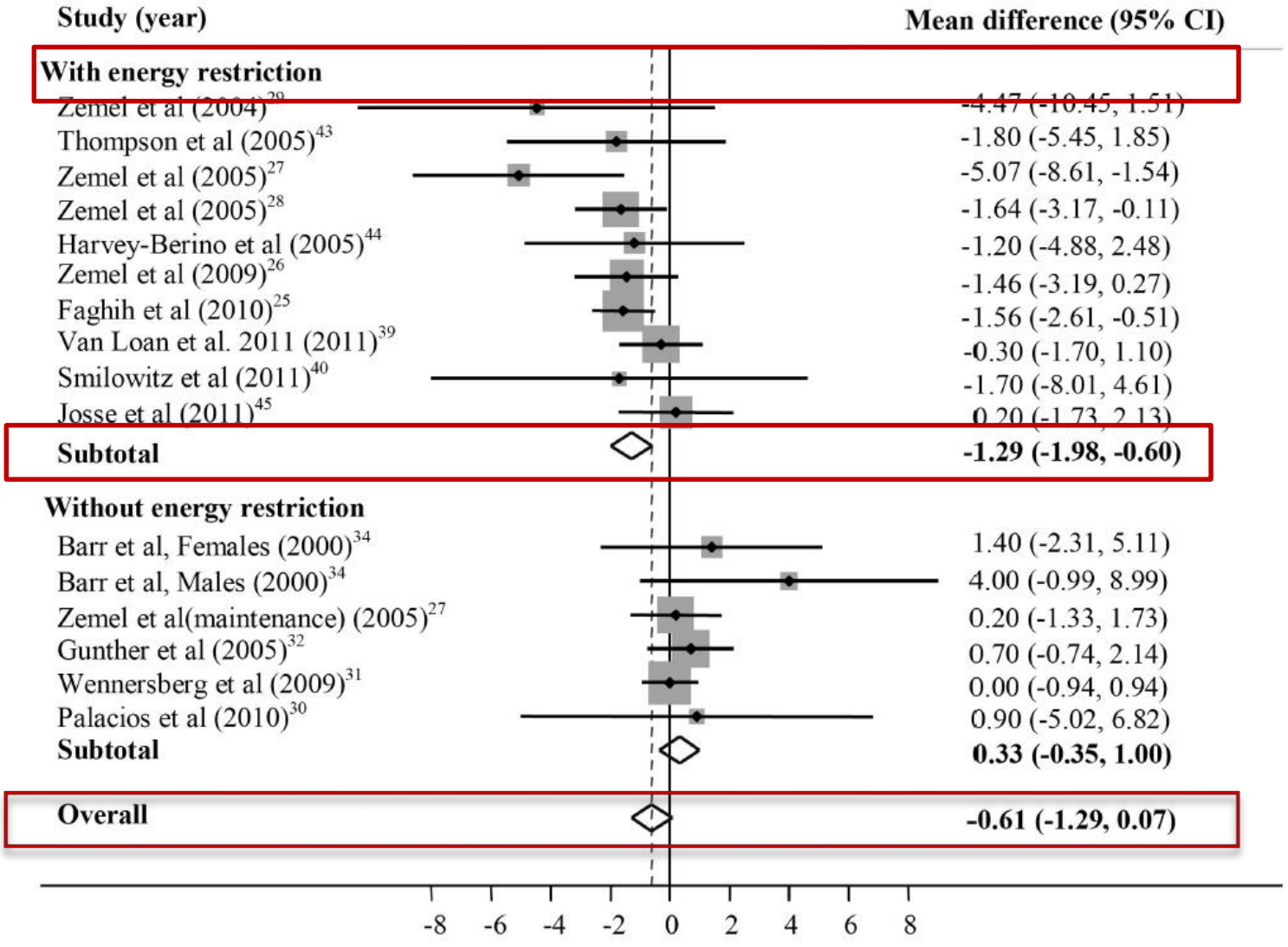
This paper has been amended from an Original Article to a Review since Advance Online Publication

AS Abargouei[1,2], M Janghorbani[3], M Salehi-Marzijarani[3] and A Esmaillzadeh[1,2]

BACKGROUND: Although several observational and experimental studies have investigated the effect of dairy consumption on weight and body composition, results are inconsistent.
OBJECTIVE: This systematic review and meta-analysis was conducted to summarize the published evidence from randomized controlled clinical trials (RCTs) regarding the effect of dairy consumption on weight, body fat mass, lean mass and waist circumference (WC) in adults.
DESIGN: PubMed, ISI Web of Science, SCOPUS, Science Direct and EMBASE were searched from January 1960 to October 2011 for relevant English and non-English publications. Sixteen studies were selected for the systematic review and fourteen studies

varied between 21 and 48 weeks. In these studies, calcium intake by 400–850 mg per day via dairy

find the source of this heterogeneity even after furth analyses based on sex, age group and meta-regressio



rest plot of randomized controlled trials illustrating weighted mean difference in weight change between the dairy-su groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the studies com

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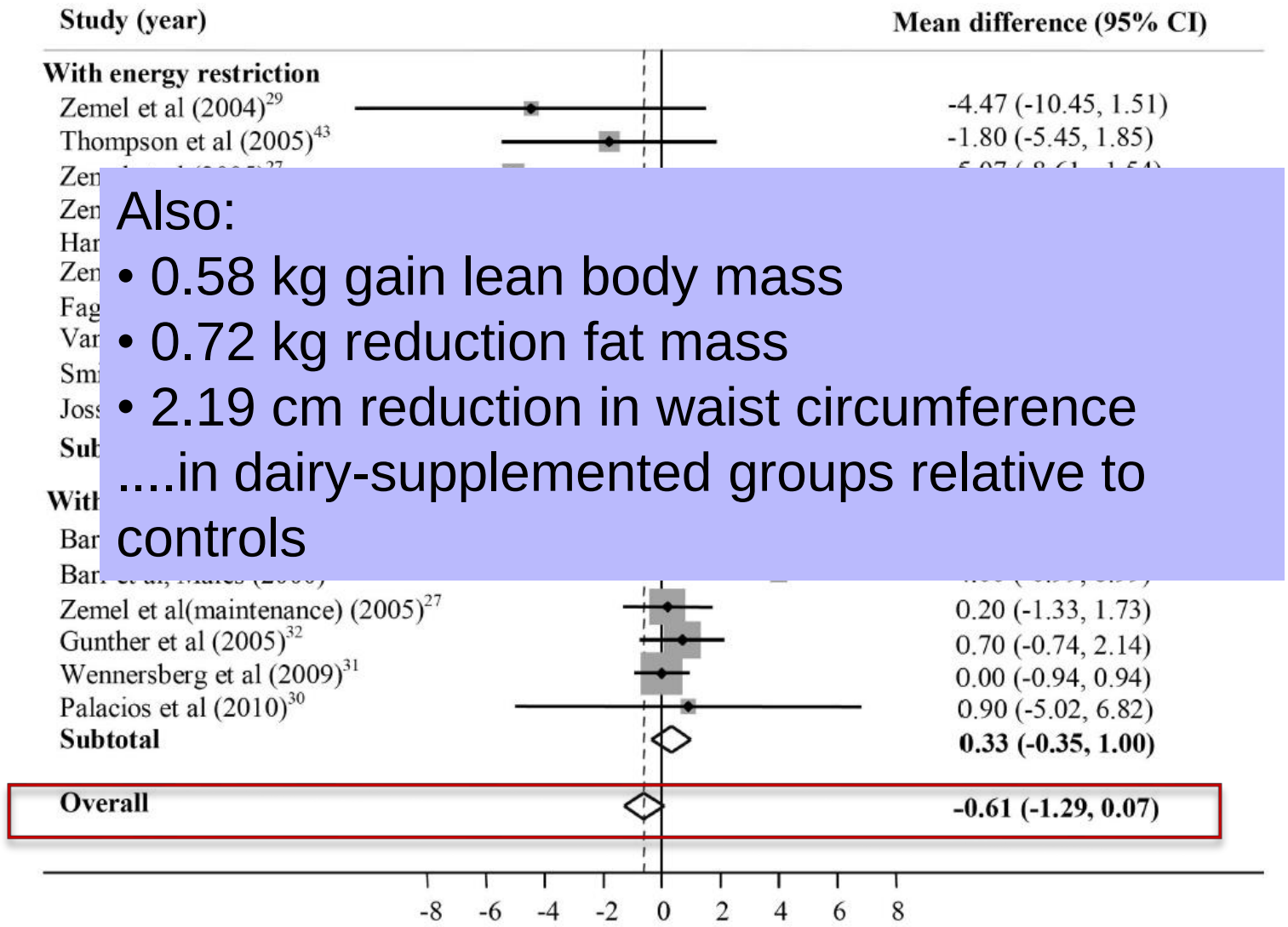


Also:

- 0.58 kg gain lean body mass
- 0.72 kg reduction fat mass
- 2.19 cm reduction in waist circumference

....in dairy-supplemented groups relative to controls

rest plot of randomized controlled trials illustrating weighted mean difference in weight change between the dairy-su groups for all eligible studies as well as for subgroup analysis based on energy restriction. For all the studies comb

Dairy and weight: systematic review & meta-analysis

The American Journal of Clinical Nutrition

Effects of dairy intake on body weight and fat: a meta-analysis of randomized controlled trials[1–4]

Mu Chen, An Pan, Vasanti S Malik, and Frank B Hu

ABSTRACT

Background: Some intervention studies have suggested that dairy products may influence body weight, but the results remain controversial.

Objective: We identified and quantified the effects of dairy consumption on body weight and fat mass from randomized controlled trials (RCTs).

Design: We conducted a comprehensive search of PubMed and EMBASE databases (to April 2012) of English reports of RCTs regarding dairy consumption on body weight, body fat, or body weight and body fat in adults. The results across studies were pooled by using a random-effects meta-analysis.

Results: Twenty-nine RCTs were included with a total of 2101 participants. Overall, consumption of dairy products did not result in a significant reduction in weight (−0.14 kg; 95% CI: −0.66, 0.38 kg; I^2 = 86.3%). In subgroup analysis, consumption of dairy products reduced body weight in the context of energy restriction or short-term intervention (<1 y) trials but had the opposite effect in ad libitum dietary interventions or long-term trials (≥1 y). Twenty-two RCTs that reported results on body fat showed a modest reduction in the dairy group (−0.45 kg; 95% CI: −0.79, −0.11 kg; I^2 = 70.9%), and further stratified analysis indicated significant beneficial effects of dairy intervention on body fat in energy-restricted or short-term trials

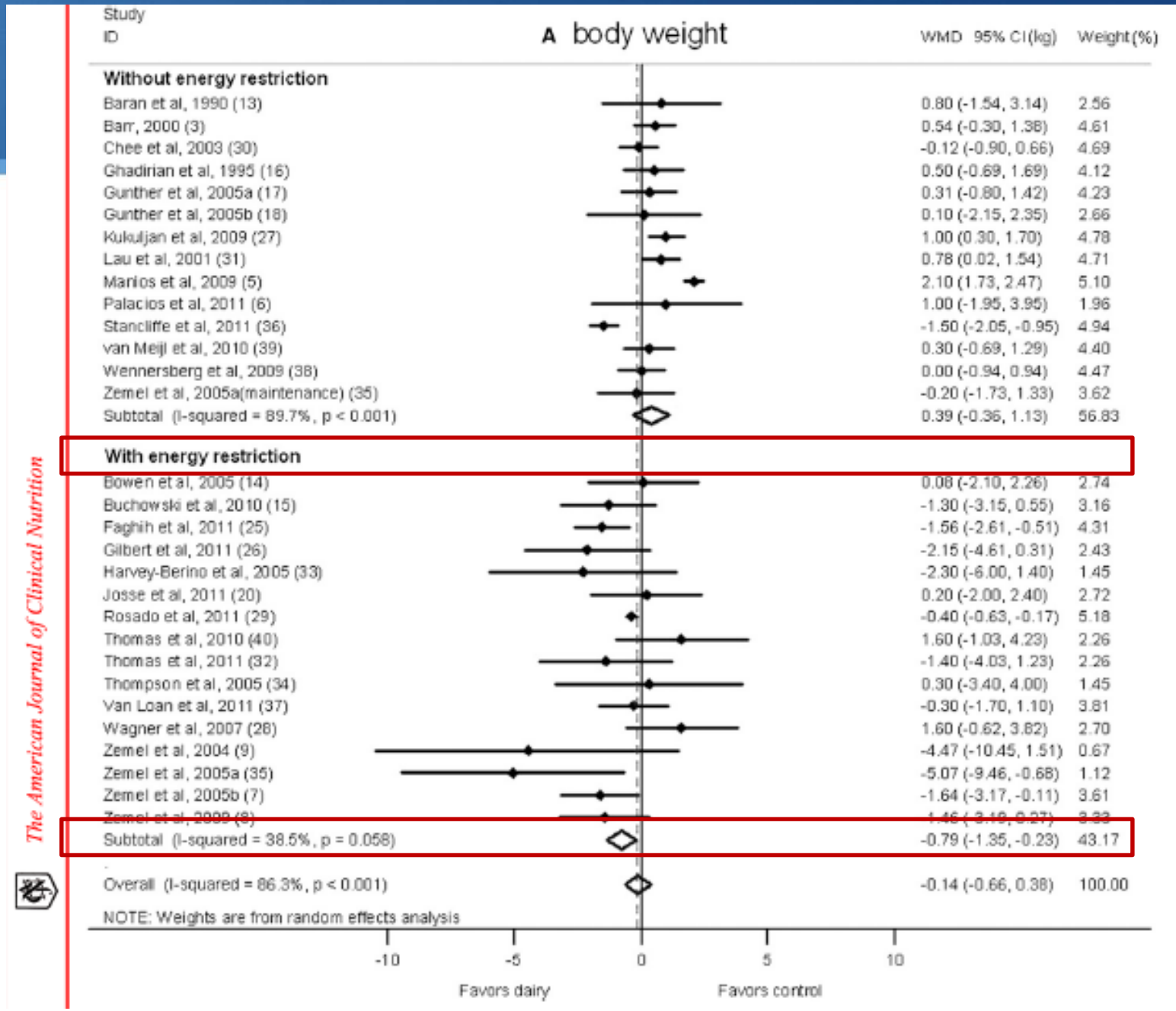
diversity of study populations. Thus, a meta-analysis is needed to increase the statistical power and enhance the precision of estimates across multiple modest-sized trials. Recently, a meta-analysis (10) on this topic was published, but a number of eligible studies were not included, and the result from one trial was repeatedly used. These methodologic issues may have led to biased results, and incomplete study selection may have impaired the statistical power to detect influential factors on the pooled estimates, such as study duration. Therefore, to achieve a more precise estimation of effects across trials, we performed a systematic review and meta-analysis on RCTs to evaluate whether increasing the consumption of dairy products could promote weight loss.

METHODS

Data sources and searches

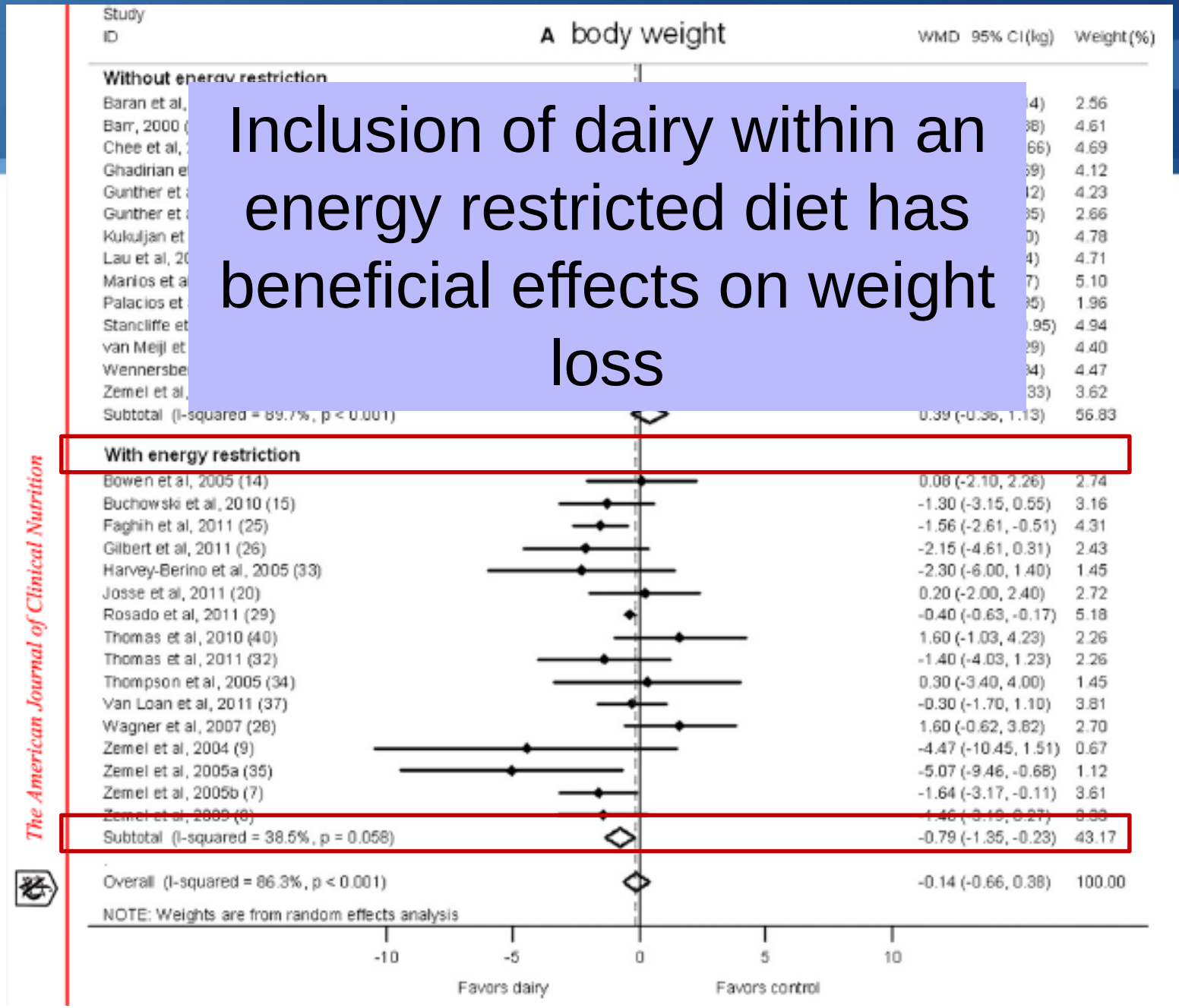
This meta-analysis was conducted after a review protocol (11). We searched PubMed (http://www.nlm.nih.gov/pubs/factsheets/pubmed.html) and EMBASE (http://www.embase.com) databases for clinical trials published from January 1966 to April 2012 that described the effects of dairy products on body weight and composition in adults. We specified 2 comprehensive search

Am J Clin Nutr 2012; 96:735-47



The American Journal of Clinical Nutrition

Inclusion of dairy within an energy restricted diet has beneficial effects on weight loss



Studying the effect of the matrix

Dairy matrix effect - Weight

Nutrition, Metabolism & Cardiovascular Diseases (2011) 21, 499–503

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/nmcd

Nutrition, Metabolism & Cardiovascular Diseases

Comparison of the effects of cows' milk, fortified soy milk, and calcium supplement on weight and fat loss in premenopausal overweight and obese women

Sh Faghih [a], A.R. Abadi [b], M. Hedayati [c], S.M. Kimiagar [a,*]

[a] *Department of Nutrition, Faculty of Nutrition Sciences and Food Technology, Arghavan Ave, Farahzadi Bulv, Tehran, Iran*
[b] *Department of Statistics, Faculty of Medicine, Evin, Tehran, Iran*
[c] *Obesity Research Center, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences,*

Faghih et al, 2011

- 100 healthy OW/OB pre-menopausal women
- Randomised, 8 weeks:
  - Control diet – 500 kcal/d deficit
  - Calcium supplemented diet – 800 mg/d + 500kcal/d deficit
  - Milk diet – 3 servings/d + 500 Kcal/d deficit
  - Soy milk – 3 servings calcium fortified soy milk + 500 kcal/d deficit

Faghih et al, 2011

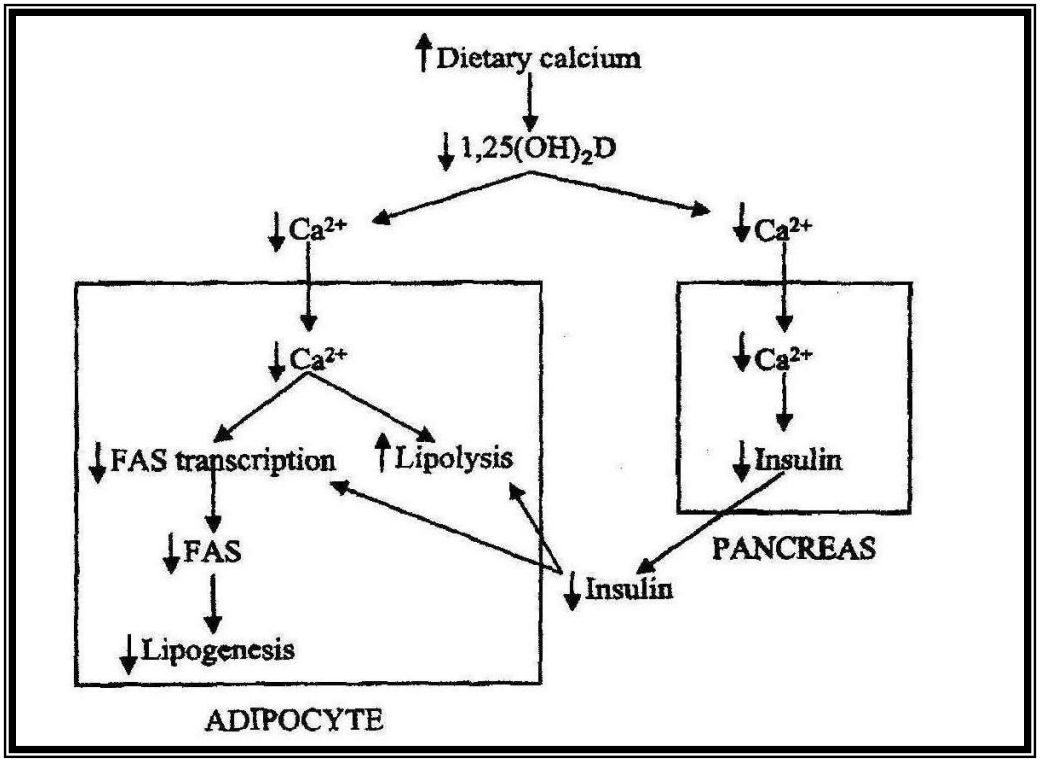
- Weight reductions after 8 weeks:

Control	Soy milk	Ca supplement	Milk diet
2.87 ± 1.55 kg (3.8%)	3.46 ± 1.28 Kg (4.3%) (0.59 kg)	3.89 ± 2.40 kg (4.8%) (1.02 kg)	4.43± 1.93 kg (5.8%) (1.56 kg)*

- No significant differences in changes in body weight and BMI between the soy milk or Ca suppl & control.
- Reductions in weight and BMI were significantly greater in the milk group compared to controls.
- Greatest changes were seen in high dairy group - % weight loss in milk group was significantly greater than in soy milk group and controls.

Mechanisms

Effect of dietary calcium on adipocytes – ↓ lipogenesis/↑ lipolysis.



St –Ogne MP. Am J Clin Nutr 2005;81:7–15.

Mechanisms

- Formation of insoluble calcium fatty acids soaps – faecal fat excretion
- Satiety
- Likely to be a combination of factors that contribute and interactions amongst several components

Bone health

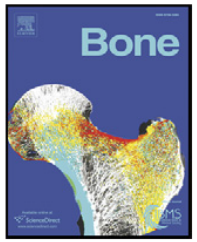
Dairy and bone health in children

Bone 43 (2008) 312–321

Contents lists available at ScienceDirect

Bone

journal homepage: www.elsevier.com/locate/bone



Impact of dairy products and dietary calcium on bone-mineral content in children: Results of a meta-analysis

Michael Huncharek [a,b,*], Joshua Muscat [b,c], Bruce Kupelnick [b]

[a] Division of Preventive Medicine, University of South Carolina School of Medicine, Columbia, SC, 29209, USA
[b] Meta-Analysis Research Group, 10 Sasanqua Circle, Columbia, SC, USA
[c] Department of Health Evaluation Sciences, Pennsylvania State University College of Medicine, Hershey, PA, USA

ARTICLE INFO

Article history:
Received 20 September 2007
Revised 27 February 2008
Accepted 28 February 2008
Available online 15 March 2008

ABSTRACT

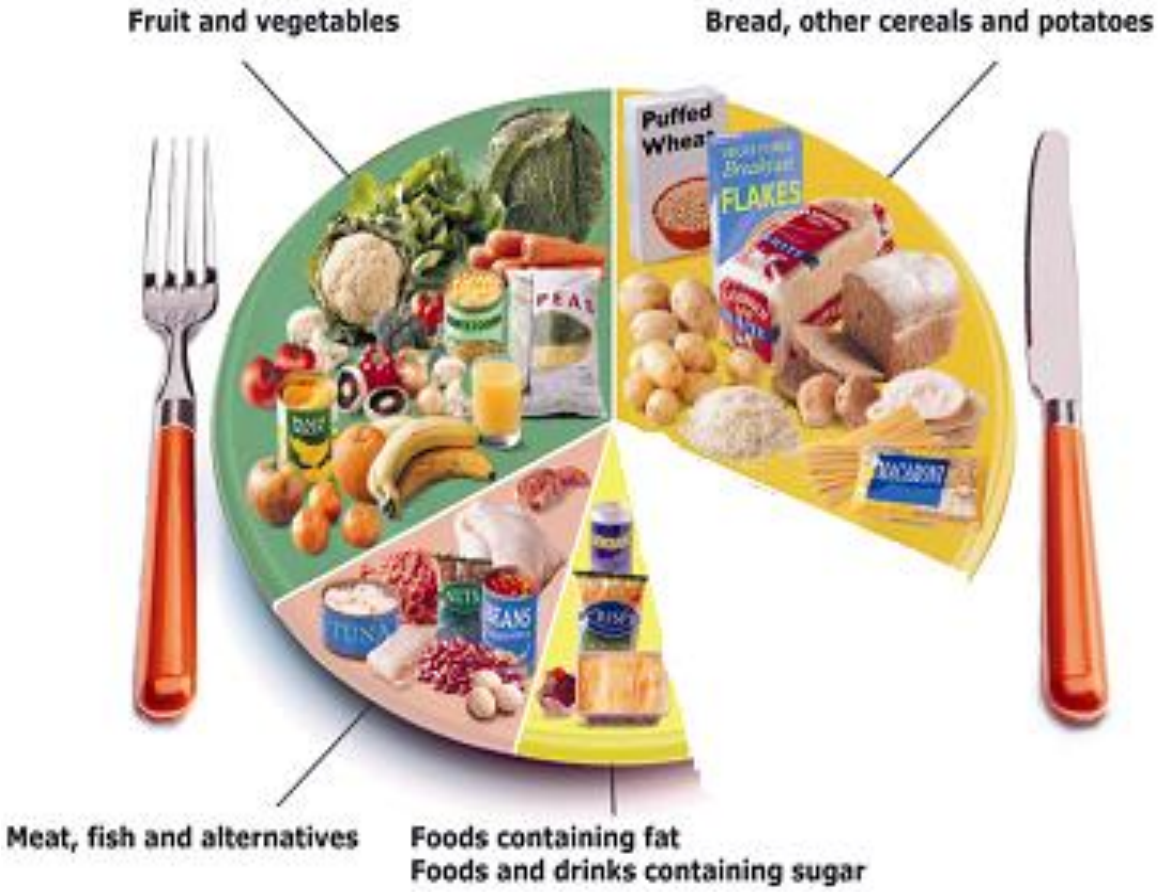
Objective: Although calcium is essential for maintaining bone health in children, the optimum dietary intake of calcium in this age group, particularly in the form of dairy foods, is not well defined. A meta-analysis was conducted to examine the impact of dietary calcium/dairy supplementation on bone mineral content in this age group.

Methods: Data were pooled from randomized controlled intervention trials and observational studies using

Meta-analysis results

- 21 randomised controlled trials included
- Overall – no statistically significant increase in total body bone mineral content (BMC)
- Sensitivity analyses according to baseline calcium intake
- Conclusion – “Increased dietary calcium/dairy products with and without vitamin D, significantly increases total body & lumbar spine BMC in children with low base-line intakes.”

Milk avoidance and bone health in children



Milk avoidance and bone health in children

- **Young children avoiding milk are prone to fractures**

  (Black et al. J Am Diet Assoc 2004;104:250-3):

  - Based on examination of fracture history of 50 children who had avoided milk for prolonged periods compared with a birth cohort of >1000 children from same city.
  - Observed = 22; Expected = 8

- **Risk factors for fractures and recurrent fractures(RF) in children (50 children RF; 50 children 1st; 50 fracture-free controls):**

  - Children with recurrent factures had a significantly lower milk intake, lower physical activity, higher BMI, higher intake carbonated drinks

  (Manias et al. Bone 2006;652-657)

Dairy matrix effect - Bone

Am J Clin Nutr 2005;82:1115–26.

See corresponding CME exam on page 1147.

Effects of calcium, dairy product, and vitamin D supplementation on bone mass accrual and body composition in 10–12-y-old girls: a 2-y randomized trial[1–3]

Sulin Cheng, Arja Lyytikäinen, Heikki Kröger, Christel Lamberg-Allardt, Markku Alén, Arvo Koistinen, Qing Ju Wang, Miia Suuriniemi, Harri Suominen, Anitta Mahonen, Patrick HF Nicholson, Kaisa K Ivaska, Riitta Korpela, Claes Ohlsson, Kalervo H Väänänen, and Frances Tylavsky

ABSTRACT

Background: Little is known about the relative effectiveness of calcium supplementation from food or pills with or without vitamin D supplementation for bone mass accrual during the rapid growth period.

Objective: The purpose was to examine the effects of both food-based and pill supplements of calcium and vitamin D on bone mass

Calcium metabolism during childhood is complex, and the degree of positive calcium balance necessary to achieve maximum peak bone mass is not known. Recent studies have shown that calcium intake and skeletal modeling determine calcium balance during growth and that childhood is a time of high calcium requirements (1, 2). Calcium supplementation intervention studies in children have shown that daily supplementation

Study design – Cheng et al,2005

The American Journal of Clinical Nutrition

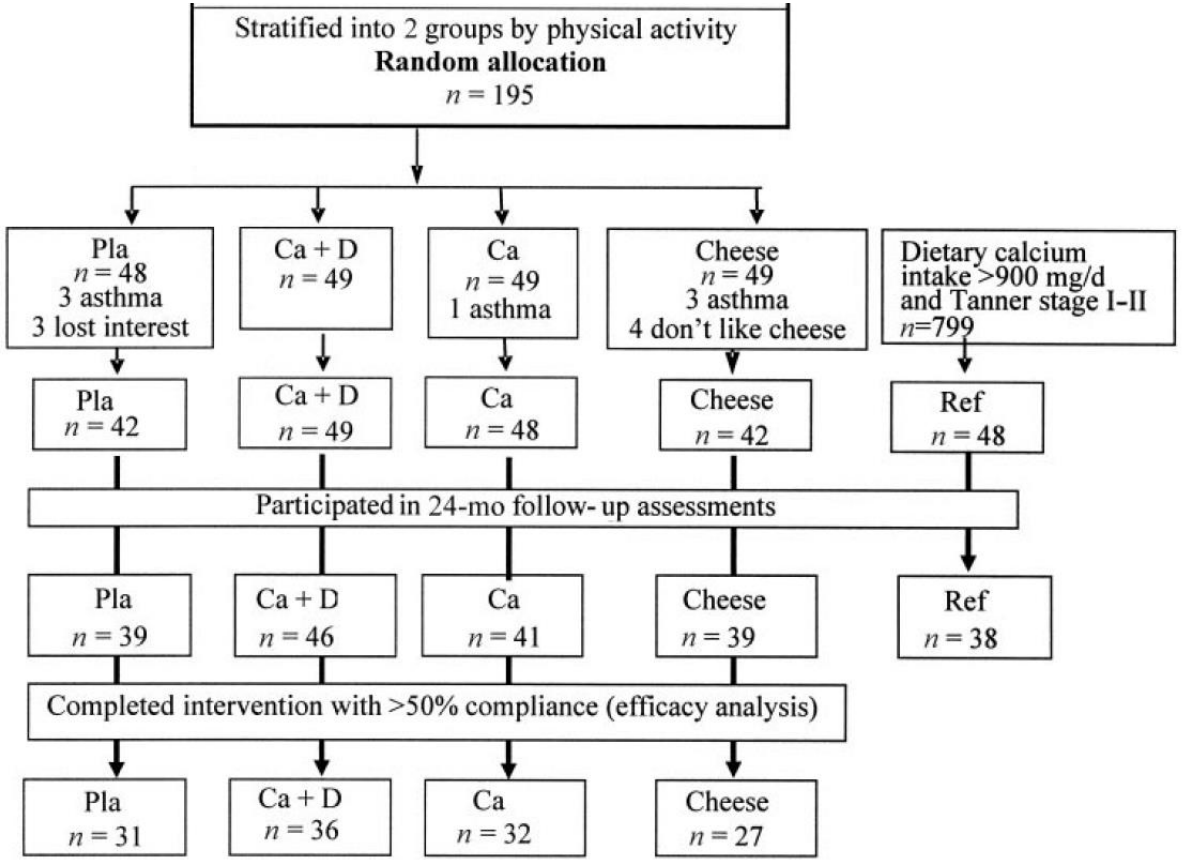


FIGURE 1. Intervention profile. Groups are as follows: Pla, calcium placebo + vitamin D placebo; Ca+D, 1000 mg Ca + 200 IU vitamin D_3; Ca, 1000 mg Ca + vitamin D placebo; cheese, 1000 mg Ca from supplemented dairy products; Ref, reference.

Cheng et al, 2005

Cheese	Ca supplement	Ca + D supplement	Placebo

- Cheese group – significantly higher percentage change in cortical thickness of tibia than placebo *or* calcium *or* calcium + vitamin D group.
- Also higher whole-body bone mineral density than placebo when compliance >50%.
- Cheese more beneficial for bone mass accrual than the use of Ca supplement.

Dairy matrix effect - Bone

Am J Clin Nutr 2007; 86:781-9

The American Journal of Clinical Nutrition

Changes in biochemical indexes of bone metabolism and bone mineral density after a 12-mo dietary intervention program: the Postmenopausal Health Study[1–3]

Yannis Manios, George Moschonis, George Trovas, and George P Lyritis

ABSTRACT

Background: In southern Europe, calcium supplementation alone is a common practice for osteoporosis prevention.

Objective: We examined whether calcium supplementation could be as effective in achieving favorable bone mass changes in postmenopausal women as is a holistic dietary approach including dairy products fortified with calcium and vitamin D_3.

Design: A sample of 101 postmenopausal women were randomly assigned to a dairy intervention group ($n = 39$) who received daily ≈1200 mg Ca and 7.5 μg vitamin D_3 via fortified dairy products and attended biweekly nutrition education sessions; a calcium-supplemented group ($n = 26$) who received a total of 1200 mg Ca/d; and a control group ($n = 36$).

Results: The increases observed in serum concentrations of insulin-like growth factor I were greater in the dairy intervention group than in the 2 other groups, especially during the first 5 mo of intervention ($P = 0.034$). The decreases and increases observed during 5 and 12 mo, respectively, in serum 25-hydroxyvitamin D_3 were significant in all groups ($P = 0.050$). Serum parathyroid hormone increased only in the control group, and serum type 1 collagen cross-linked C-telopeptide decreased only in the dairy intervention group during both 5 and 12 mo of intervention ($P = 0.035$ and 0.047, respectively). The dairy intervention group had greater improvements in pelvis ($P = 0.040$), total spine ($P = 0.001$), and total-body ($P = 0.001$) bone mineral density than did the other 2 groups.

Greece has increased significantly: from 1977 to 1992, age-adjusted incidence in Greek persons aged >50 y increased by 80.9% (2).

The adequate intake of certain nutrients that are essential for bone metabolism, such as calcium and vitamin D, plays an important role in maintaining bone mass. With increasing age, however, both dietary calcium intake and intestinal calcium absorption decrease (3). Furthermore, in the elderly, serum concentrations of 25-hydroxyvitamin D_3 [25(OH)D_3] decline, mostly because of decreased sunlight (ultraviolet B irradiation) exposure, which leads to a limited capacity for cutaneous vitamin D synthesis (4). Combined with low dietary intake of vitamin D from staple foods, especially in countries without mandatory fortification policy (5), these factors contribute to lower concentrations of 25(OH)D_3 and consequently to accelerated bone loss and greater risk of bone fracture (6, 7). It has been reported that meeting daily dietary requirements of calcium and vitamin D produces a significant reduction in the incidence of bone fracture (8, 9).

Although low bone mineral density (BMD) has been identified as one of the stronger predictors of future bone fracture, the serum concentrations of several biomarkers of bone remodeling have also been proposed as important predictors of BMD loss (10). According to recent evidence, supplementation with cal-

Manios et al, 2005

Dairy group

Ca supplement

Control

Am J Clin Nutr 2007; 86:781-9.

Manios et al, 2005

Dairy group

Ca supplement

Control

..... consumption of fortified dairy products for a period of 12 mo induced favorable changes in biochemical indexes of bone remodeling, calciotropic hormones, and pelvis, total spine, and total-body BMD. In contrast, no such favorable changes in either biochemical indexes or BMD were obtained in the CaG, the group that was supplemented only with the recommended amount of calcium. The favorable changes observed in the DG may not be attributed solely to the greater intakes of calcium and vitamin D but also to other, less studied ingredients of dairy products. Recent research has highlighted the important roles of magnesium and other micronutrients (47) and of milk protein (48) in bone metabolism. It has been suggested that the effect of dairy products on bone health may be greater than can be accounted for by any single constituent and that milk ingredients as a whole may be more effective than the sum of their individual parts (47).

Am J Clin Nutr 2007; 86:781-9.

Maintenance muscle mass

Healthy ageing – living well for longer

Sarcopenia

- Sarcopenia – the progressive decrease in lean body mass and strength with age
- Affects up to 45% of those aged over 60y

Sarcopenia

- Sarcopenia – the progressive decrease in lean body mass and strength with age
- Affects up to 45% of those aged over 60y

↑ fatigue, ↓ appetite, ↓QoL

Physical impairment, disability and dependence on others

Impairs the metabolic adaptation to illness & disease

Minimising sarcopenia

- Increased protein intake has been suggested for older adults to minimise risk of sarcopenia – more evidence required before definitive recommendations can be made.
- Milk protein – attractive candidate for increasing muscle protein synthesis in older people (& nutrient density also generally beneficial for older people).....

Dairy protein & muscle mass older men RCT

Clinical Interventions in Aging

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Nutrient-rich dairy proteins improve appendicular skeletal muscle mass and physical performance, and attenuate the loss of muscle strength in older men and women subjects: a single-blind randomized clinical trial

This article was published in the following Dove Press journal:
Clinical Interventions in Aging
12 September 2014
Number of times this article has been viewed

Heliodoro Alemán-Mateo[1]
Virginia Ramírez Carreón[1]
Liliana Macías[1]

Background: At present, it is unknown whether the use of nutrient-rich dairy proteins improves the markers of sarcopenia syndrome. Therefore, our proposal was to investigate whether adding 210 g of ricotta cheese daily would improve skeletal muscle mass, handgrip strength, and

Dairy protein & muscle mass older men RCT

Table 2 Relative changes in body weight, and markers of sarcopenia at baseline and 12 weeks of follow-up

	IG/HD + RCH (Ricotta cheese)			CG/HD (Control)			*P*-value
	Baseline	**Follow-up**	**Relative change (%)**	**Baseline**	**Follow-up**	**Relative change (%)**	
Men/women, n	25/24	25/24		24/25	24/25		
Weight, kg	70.3±11.7	70.8±12.0	0.6±2.6	71.6±10.8	71.4±10.8	−0.3±2.5	0.06
Fat, kg	25.6±7.9	26.0±8.5	1.6±6.1	25.7±7.9	26.1±8.0	1.7±6.5	0.91
Truncal fat, kg	14.9±4.6	15.2±4.8	1.5±7.4	15.3±4.7	15.5±4.6	1.2±6.4	0.81
TLT, kg	40.6±8.6	40.7±8.4	0.4±3.0	41.7±8.4	41.3±8.7	−0.9±2.7	0.02
LTA, kg	4.4±1.2	4.4±1.2	−1.2±3.5	4.5±1.1	4.4±1.1	−3.2±4.2	0.02
LTL, kg	13.1±3.0	13.3±2.9	1.3±4.1	13.4±3.1	13.4±3.0	−0.28±3.2	0.03
ASMM, kg	17.6±4.2	17.6±4.1	0.6±3.5	18.0±4.1	17.8±4.1	−1.0±2.6	0.009
ASMMI, kg/m^2	6.6±1.0	6.7±0.9	0.7±3.43	6.8±1.0	6.7±1.0	−1.1±2.6	0.004
Total mass, kg	68.6±11.6	69.2±11.9	0.9±2.6	70.1±10.7	70.0±10.8	−0.2±2.6	0.05
Strength, kg	24.1±9.5	23.8±9.3	−0.6±10.8	24.1±8.7	23.1±8.8	−4.5±10.8	0.07
SPPB, score	10.7±1.7	10.8±1.5	2.4±9.9	10.9±1.4	11.0±1.3	1.2±9.3	0.55
Balance, score	2.9±0.4	2.9±0.3	3.7±17.1	3.0±0.2	2.9±0.3	−2.4±12.7	0.05
Gait speed, m/s	5.1±1.0	4.6±1.0	6.3±23.7	5.2±1.2	4.5±0.8	8.6±22.3	0.63
Five chair rise, seconds	10.5±3.7	10.6±3.2	−0.8±16.0	11.4±2.6	11.3±2.4	−0.2±15.1	0.83
SCPT, W	204.2±60.4	203.5±57.1	0.5±9.8	211.3±54.6	203.9±52.2	−2.8±11.4	0.10

Notes: Data are presented as means ± standard deviation. SPPB score ranges from 0 to 12. The score for each SPPB component ranges from 0 to 4.
Abbreviations: TLT, total lean tissue; LTA, lean tissue in arms; LTL, lean tissue in legs; ASMM, appendicular skeletal muscle mass; ASMMI, ASMM index; SPPB, short physical performance battery; SCPT, stair-climb power test; IG/HD + RCH, intervention group – ricotta cheese + habitual diet; CG/HD, control group – habitual diet.

Blood Pressure

Dietary Approaches to Stop Hypertension (DASH)

The New England
Journal of Medicine

VOLUME 336 APRIL 17, 1997 NUMBER 16

A CLINICAL TRIAL OF THE EFFECTS OF DIETARY PATTERNS ON BLOOD PRESSURE

LAWRENCE J. APPEL, M.D., M.P.H., THOMAS J. MOORE, M.D., EVA OBARZANEK, PH.D., WILLIAM M. VOLLMER, PH.D., LAURA P. SVETKEY, M.D., M.H.S., FRANK M. SACKS, M.D., GEORGE A. BRAY, M.D., THOMAS M. VOGT, M.D., M.P.H., JEFFREY A. CUTLER, M.D., MARLENE M. WINDHAUSER, PH.D., R.D., PAO-HWA LIN, PH.D., AND NJERI KARANJA, PH.D., FOR THE DASH COLLABORATIVE RESEARCH GROUP*

DASH – 8 wk, controlled feeding study

Control
(typical American)

High fruit & veg

High fruit & veg +
low-fat dairy

DASH - results

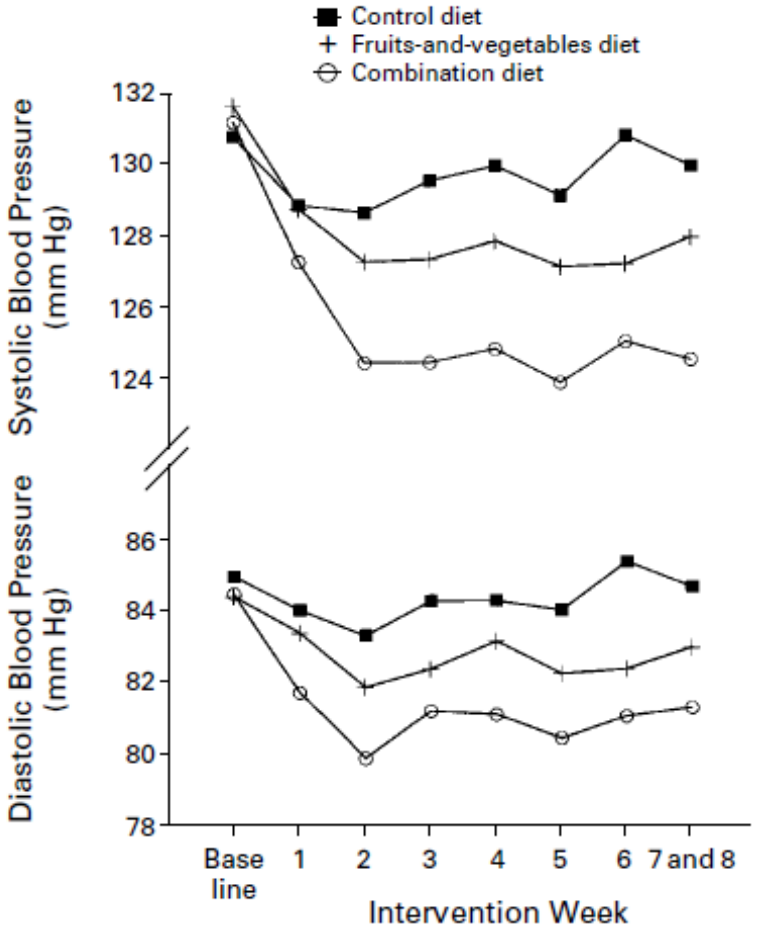


Figure 1. Mean Systolic and Diastolic Blood Pressures at Base Line and during Each Intervention Week, According to Diet, for 379 Subjects with Complete Sets of Weekly Blood-Pressure Measurements.

Compared with control diet:

- **FV diet** reduced SBP by 2.8 mmHg more and DBP by 1.1 mmHg more
- **Combination diet** reduced SBP by 5.5 mmHg more & DBP by 3 mmHg more

For those who had hypertension – even more pronounced effect:

- **Combination diet** reduced SBP by 11.4 mmHg more & DBP by 5.5 mmHg more

DASH – Higher fat

The American Journal of Clinical Nutrition

Comparison of the DASH (Dietary Approaches to Stop Hypertension) diet and a higher-fat DASH diet on blood pressure and lipids and lipoproteins: a randomized controlled trial[1–3]

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ABSTRACT

Background: The DASH (Dietary Approaches to Stop Hypertension) dietary pattern, which is high in fruit, vegetables, and low-fat dairy foods, significantly lowers blood pressure as well as low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol.

Objective: The study was designed to test the effects of substituting full-fat for low-fat dairy foods in the DASH diet, with a corresponding increase in fat and a reduction in sugar intake, on blood pressure and plasma lipids and lipoproteins.

Design: This was a 3-period randomized crossover trial in free-living healthy individuals who consumed in random order a control diet, a standard DASH diet, and a higher-fat, lower-carbohydrate modification of the DASH diet (HF-DASH diet) for 3 wk each, separated by 2-wk washout periods. Laboratory measurements, which included lipoprotein particle concentrations determined by ion mobility, were made at the end of each experimental diet.

Results: Thirty-six participants completed all 3 dietary periods. Blood pressure was reduced similarly with the DASH and HF-DASH diets compared with the control diet. The HF-DASH diet significantly reduced triglycerides and large and medium very-low-density lipoprotein (VLDL) particle concentrations and increased LDL peak particle diameter compared with the DASH diet. The DASH diet, but not the HF-DASH diet, significantly reduced LDL cholesterol, HDL cholesterol, apolipoprotein A-I, intermediate-

adherence to a DASH-style diet was associated with a lower risk of coronary artery disease and stroke (3). Because LDL cholesterol is lower with the consumption of the DASH diet than with a typical Western diet due in part to its limitation of saturated fatty acids, it is believed that its lower saturated fat content may contribute to reduced risk of cardiovascular disease (4, 5).

The degree of dietary adherence strongly determines the efficacy of dietary interventions (6). A recent review of 9 trials of the DASH diet with objective measures of compliance reported poorer adherence when dietary advice rather than foods was provided (7). A common reason for low adherence or high attrition is the difficulty of following prescribed diets (8). In the original DASH trial, lack of menu variety was a primary reason for lapses in dietary adherence (9). This suggests the potential value of providing options for the DASH diet that permit variation in macronutrient composition while preserving benefits on BP and lipid risk factors.

One such variation is the substitution of fat for carbohydrate. Appel et al. (10) reported that the replacement of 10% of energy from carbohydrate with unsaturated fat (primarily monounsaturated) in a DASH-like diet resulted in a reduction in triglycerides and an increase in HDL cholesterol, with no change in LDL cholesterol, and a further reduction in the Framingham risk score. There is

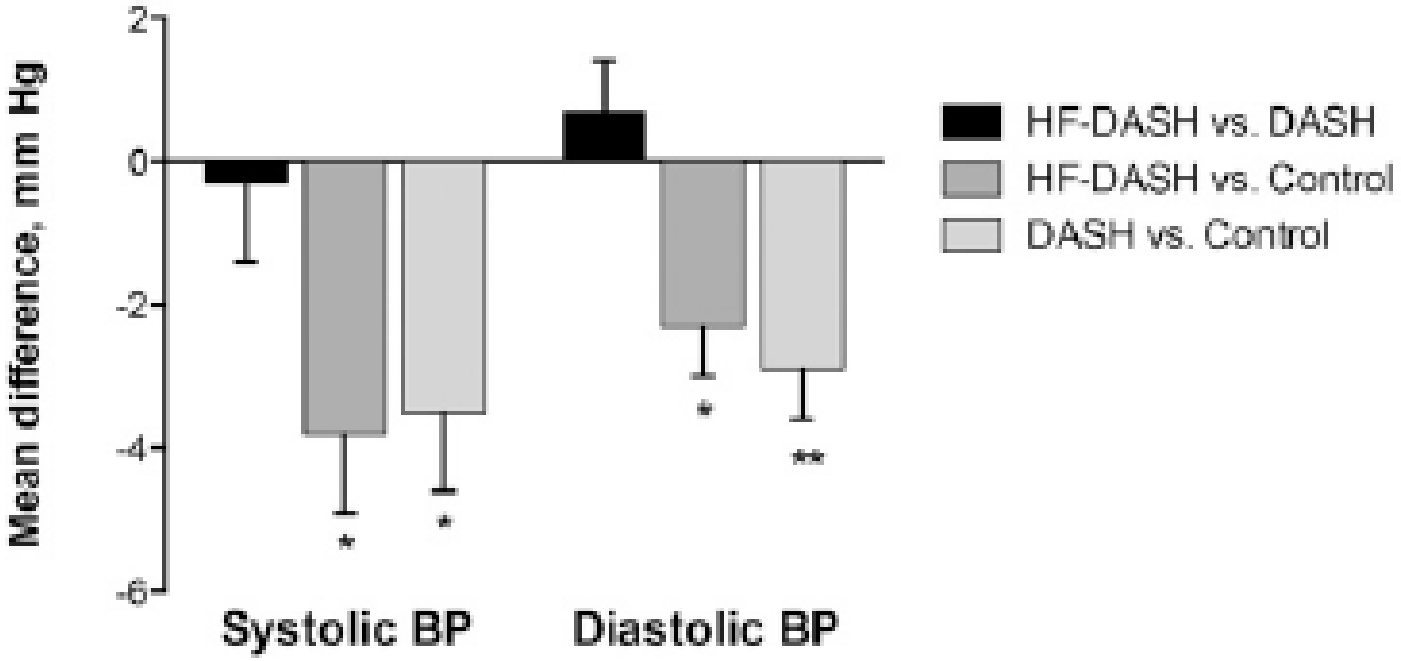

FIGURE 2 Differences between diets in systolic and diastolic BP. $*P < 0.017$, $**P < 0.001$. Values are means ± SEs, adjusted for dietary period; $n = 36$. Data were analyzed by ANOVA for a 3-treatment crossover design. BP, blood pressure; DASH, Dietary Approaches to Stop Hypertension diet; HF-DASH, high-fat, low-carbohydrate DASH diet.

Dairy matrix effect – BP

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POSTER SESSIONS

FEATURED POSTER SESSION GROUP I

FP-1

Randomized, double-blind, placebo-controlled, cross-over study on the antihypertensive effect of dietary integration with Grana Padano DOCG cheese

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Cow-milk fermentation induced by *Lactobacillus helveticus* produces peptides with sustained ACE inhibitory activity, mainly dues to 2 tripeptides (valyl-prolyl-proline and isoleucil-prolyl-proline) that have shown to lower blood pressure (BP) in experimental animals and in humans. Grana Padano DOCG, an Italian semi-fat hard cheese, has shown a potent *in-vitro* ACE-inhibitory effect due its high concentration of such tripeptides. In a previous randomized, open-label, controlled study, the daily dietary integration with Grana Padano cheese was accompanied by significant decrease in systolic and diastolic BP in hypertensive patient (Crippa et al, J Clin Hypertens, 2013). Present data refers to a ran-

Crippa et al, 2016

Grand Pandano Cheese 30g/d

Placebo (flavoured bread + fat, salt equal to cheese)

- Crossover trial; 2 mths
- Mild to moderate hypertension; n=30
- No change BMI
- Cheese decreased office + ambulatory BP (7-8 mmHg SBP; 5-7mmHg DBP) relative to a decrease of 1-3mmHg for placebo

Conclusion

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- Intervention studies support a benefit of dairy foods for body weight, muscle and bone health and blood pressure
- Furthermore, trials indicate that the effects of whole dairy may be different than those of single dairy constituents supporting a dairy matrix effect