Nutrition & Health Benefits of Dairy

Mitch Kanter, PhD
Science/Technical Director
Global Dairy Platform
A **sustainable food system** is one that delivers **food security** and **nutrition** for all in such a way that the **economic, social** and **environmental** bases to generate food security and nutrition for future generation is not compromised.

FAO 2020
Dairy is a vital component of a healthy, sustainable food system.
Population Growth

World Population: 1950-2050

- Source: U.S. Census Bureau, International Data Base, December 2008 Update.
Dairy is a Core Part of Global Dietary Guidelines

- **Arab Countries**: 2-3 servings of dairy products per day
- **Argentina**: Consume daily milk, yogurt, or cheese. It is necessary for all age groups
- **Australia**: 3 servings of reduced-fat dairy per day
- **Brazil**: 3 portions of low-fat milk and dairy products
- **Canada**: 2-3 servings for children (2-8 yrs), adults (10-61+); 3-4 servings for children and teens (9-18 yrs)
- **China**: 100 g per day of dairy products
- **France**: 3 servings per day for adults; 3-4 servings for children and adolescents
- **Hong Kong**: 1-2 glasses of milk per day
- **Ireland**: 3 servings of low-fat milk, cheese, yogurt per day for adults. 5 servings per day for children (0-18 yrs)
- **Japan**: 2 servings of milk/milk products a day
- **Malaysia**: 1-2 daily servings for adults; 2 daily servings for children (2-6 yrs)
- **Spain**: 2 servings per day; preferably low-fat
- **Switzerland**: 3 portions of milk or dairy per day
- **Thailand**: 1-2 glasses of milk/yogurt per day
Dairy Foods are Naturally Nutritious

- Niacin
- Calcium
- Magnesium
- Fat
- Protein
- Vitamin A
- Potassium
- Zinc
- Phosphorus
- Vitamin B12
- Vitamin B6
- Riboflavin
Improving Dietary Protein Quality Reduces the Negative Effects of Physical Inactivity on Body Composition and Muscle Function

E. Arentson-Lentz et al.
J. Gerontol 2019 doi:10 1093/gernona/glz003

- Additional of whey to diet of healthy men and women subject to 7 days of bedrest
- Conclusion: During bedrest Improving protein quality without increasing total energy intake has the potential to partially counter some of the negative effects of bed rest in older adults.
Growing Evidence: Dairy Intake May Have a Beneficial Association with Risk for Cardiovascular Disease

“...there is no evidence that consumption of dairy fat or of low-fat or full-fat dairy foods are detrimental to cardiovascular-related clinical outcomes – supporting the inclusion of dairy foods, regardless of fat level, in a healthy eating pattern.”

“...dairy consumption may be associated with reduced risks of CVD, although additional data are needed to more comprehensively examine potential dose-response patterns.”
Meta-Analysis: Total Dairy Reduces Risk of Cardiovascular Disease

"...the findings of the present meta-analysis have suggested that dairy consumption (regardless of fat content) is significantly and inversely associated with the risks of CVD and stroke."

Qin et al. Asia Pac J Clin Nutr 2015
Whole milk consumption is associated with lower risk of coronary artery calcification progression: evidence from the Multi-Ethnic Study of Atherosclerosis

*Ghosh et al. Eur J Nutr 2020 Prepublication*

- Coronary artery calcification (CAC) progression is a strong predictor of cardiovascular disease (CVD) morbidity and mortality
- Recent studies highlight beneficial effects of short chain fatty acids (SCFA) from whole milk on CVD risk
- 5273 subjects completed a dietary questionnaire at baseline. Re-tested every 2 yrs. over a ten-year period
- Self-reported whole milk consumption was inversely associated with CAC progression in community dwelling participants, especially in those at relatively low CVD risk
- The beneficial effect was partially mediated by SCFA
More than 50 years with a focus on fat

1950s-1970s

American Heart Association
1961 Recommendations

2. Engage in moderate exercise, e.g., walking to aid in weight reduction.
3. Reduce intake of total fat, saturated fat, and cholesterol. Increase intake of polyunsaturated fat.
4. Men with a strong family history of atherosclerosis should pay particular attention to diet modification.
5. Dietary changes should be carried out under medical supervision.
The original diet-heart paradigm reasoned that because saturated fat raises LDL ("bad") cholesterol, and LDL cholesterol raises coronary heart disease (CHD) risk, then saturated fat raises CHD risk.

The latest evidence indicates that the real story may be more complex.
Emerging Evidence:
Saturated Fat Consumption May Not be Linked to CVD Risk

...there is no significant evidence for concluding that dietary saturated fat is associated with an increased risk of CHD or CVD.”

“Current evidence does not clearly support cardiovascular guidelines that encourage high consumption of polyunsaturated fatty acids and low consumption of total saturated fats.”
Canadian Heart & Stroke Foundation Drops Limits on Saturated Fat

There are different dietary saturated fatty acids including lauric acid, myristic acid, palmitic acid and stearic acid. There is emerging evidence to suggest that the health effects of saturated fats could vary depending on the food sources in which they are found.²

RECOMMENDATIONS

The science of nutrition is ever-evolving with new evidence emerging all the time. It is becoming increasingly clear that what has the most impact on health is the overall quality of one’s diet, combined with the types and quantity of food consumed. The following recommendations do not include a threshold or limit for saturated fat and instead focus on a healthy balanced dietary pattern, which can help Canadians reduce consumption of saturated fats.
Academy Says Not all Fats are Created Equal: Focusing on a Single Fatty Acid is Simplistic

"...fatty acids are consumed as a part of foods that contain other nutrients and dietary compounds; these have both additive and synergistic effects on health and interact in complex ways that are difficult to delineate."
Different SFAs have different biological effects, which are further modified by the food matrix and the CHO content of the diet.

Several foods relatively rich in SFAs, such as whole fat dairy, dark chocolate, and unprocessed meat, are not associated with increased CVD or diabetes risk.

There is no robust evidence that current population-wide arbitrary upper limits on SF consumption (in the US) will prevent CVD or reduce mortality.
Dairy Foods’ Matrix May Modulate Effects of Dairy Fat on Cardiovascular Disease Risk

Food source matters when it comes to the link between fat consumption and CVD risk
Dairy and blood pressure
DASH Study Showed that Dietary Changes Could Lower Blood Pressure

Three dietary patterns were tested in adults with hypertension (SBP < 160 mm Hg and DBP 80 – 95 mm Hg)

• Control, typical American diet
• A diet rich in fruit and vegetables
• A diet rich in fruit and vegetables as well as high in low-fat dairy products and with reduced saturated and total fat
Dairy Consumption Improved Indices of Vascular Stiffness and Brachial Artery Endothelial Function

Figure 1: Carotid-femoral pulse wave velocity before and after each dietary condition (A). Relation of ΔcfPWV and arterial systolic blood pressure in both conditions (B). *P < 0.05 vs. Baseline, †P < 0.05 vs. Endpoint in No Dairy condition. Values are means ± SEM.

Figure 4: Flow-mediated dilation before and after each dietary condition (n = 47). *P < 0.05 vs. Baseline. †P < 0.05 vs. Endpoint in No Dairy condition. Values are means ± SEM.
Dietary Sodium Has Differential Effects on Vascular Function Depending on the Food Source

Goal: To examine the relative effects of acute sodium ingestion in cheese and non-dairy sodium ingestion on microvascular function in healthy adults.

<table>
<thead>
<tr>
<th>Sodium Content</th>
<th>Food Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>560 mg sodium</td>
<td>cheddar cheese (3 oz.)</td>
</tr>
<tr>
<td>560 mg sodium</td>
<td>pretzels (2.3 oz.)</td>
</tr>
<tr>
<td>560 mg sodium</td>
<td>soy cheese (3 oz.)</td>
</tr>
<tr>
<td>1,120 mg sodium</td>
<td>cheddar cheese (6 oz.)</td>
</tr>
<tr>
<td>1,120 mg sodium</td>
<td>pretzels (4.6 oz.)</td>
</tr>
</tbody>
</table>

*NDC sponsored study

Vasodilation Was Lower Following Na\(^+\) Ingestion in Pretzels or Soy Cheese Compared to an Equal Na\(^+\) Load in Cheese
Immune system (Inflammation)
Dairy Foods Not Linked to Inflammation

- Eating dairy foods does not seem to be linked to increased inflammation

- In some cases eating dairy foods has been linked to reduced indicators of systemic inflammation
Eating Yogurt Linked to Reduced Inflammation

NW = normal weight
OB = obese

*NDC sponsored study

Pel et al Br J of Nutrition, 2017
Eating Yogurt Linked to Improved Gut Barrier Function

Pei et al. Br J of Nutrition; 2017

*NDC sponsored study

NW = normal weight
OB = obese

Change in EndoCab IgM (MMU/mL)

Yogurt NW  Yogurt OB  Control NW  Control OB
Probiotics and Prebiotics May Help Normalize Disturbed Microbiome and Improve Health

- Probiotics are live microbes that we consume or apply to our bodies that confer a health benefit to the host.

- Prebiotics are substrates that are selectively utilized by host microorganisms conferring a health benefit.

Bring in more good guys

Feed the good guys
The Gut Microbiome Plays an Important Role in Maintaining Health

• “All diseases begin in the gut.” (Hippocrates)
• 10x more bacteria than cells of the body
• What do they do?
  • Make vitamins and hormones; harvest energy from food; protect against pathogens; bolster the immune system; influence other body systems
• Reduced diversity or dysbiosis are associated with enterocolitis, eczema, asthma, inflammatory bowel diseases, obesity and diabetes
## Dairy Contains Bioactive Components

<table>
<thead>
<tr>
<th>Bioactive component</th>
<th>Effects and Putative Mechanism</th>
</tr>
</thead>
</table>
| Calcium, Potassium, Magnesium | SBP -1.27 to -4.6 mmHg  
DBP -0.24 to -3.8 mmHg  
(Kris-Etherton et al. *J Am Col Nutr* 2009, Suppl 1:103S-19S)  
VSM Ca+, neurohormonal control of Na+ excretion |
| α, β κ caseins: Lactotripeptides (Ile-Pro-Pro, Val-Pro-Pro, and Leu-Pro-Pro) | ACE-Inhibitor properties  
(2.6 mg/d; Engbering et al Hypertension 51:399-405, 2008) |
| Whey α-- and β-lactoglobulin, α-lactalbumin, immunoglobulins, glycomacropeptides, bovine serum albumin, lacoperoxidase, lysozyme, lactoferrin, lacoperoxidase, Ala-Leu-Pro-Met | Scavenge H₂O₂  
Glutathione synthesis  
ACE-Inhibitor properties |
Dairy and Type 2 Diabetes
Dose-Response Meta-Analyses of Prospective Cohort Studies Show Consistent Beneficial Associations Between Dairy Foods and Type 2 Diabetes Risk

Total dairy intake associated with a 7% reduced risk of type 2 diabetes per 400 g serving dairy


Total dairy intake related with a 12% reduced risk of type 2 diabetes per 200 g serving dairy

New results from the Prospective Urban Rural Epidemiology (PURE) study related to dairy food consumption and its association with risk factors of cardiovascular disease were just published.

- Prospective observational study
- Data from 147,812 individuals from 21 countries
- Participants aged between 35 and 70
- Usual dietary intake over the previous 12 months was assessed by means of Food Frequency Questionnaires
- Dairy products included milk, yogurt, yogurt drinks, cheese and dishes prepared with dairy products, and were classified as full or low fat (1-2%).
- Butter and cream were assessed separately as these are not commonly eaten in some of the countries studied.
PURE Dairy Study Results

- Total dairy and full fat dairy, but not low-fat dairy, consumption was associated with a lower prevalence of metabolic syndrome
  - A greater benefit was seen in those countries with normally low dairy intakes.
- Consumption of at least 2 servings a day of total dairy vs no dairy consumption was associated with a 24% lower risk of metabolic syndrome
  - A greater risk reduction was seen by for full fat dairy intake alone at 28%, compared with no daily dairy intake.
- Similarly, consuming at least 2 servings a day of total dairy was associated with an 11-12% lower risk of high blood pressure and type 2 diabetes.
  - The risk reduction was greater for both health conditions (13- 14%) if 3 daily servings of total dairy were consumed.
  - The associations were stronger for full fat than they were for low fat dairy.
Joslin Releases Guidelines to Reflect New Evidence Addressing Saturated Fat From Dairy Foods

“Recent evidence demonstrates saturated fat from dairy foods (milk, yogurt, cheese) may be acceptable within the total daily caloric intake”

Dairy foods are included in list of:
“Foods shown to be associated with a reduced risk of developing type 2 diabetes in some studies”
Dairy and Musculoskeletal Health
Health Authorities Recommend Nutrients in Dairy Foods to Improve Bone Health in Children

• **2011 IOM Dietary Reference Intakes for Calcium and Vitamin D:**
  Based on relationship between calcium and vitamin D and bone health throughout life

• **2014 AAP Optimizing Bone Health in Children and Adolescents:**
  “Encourage increased dietary intake of calcium- and vitamin D-containing foods and beverages” and “Children 4 through 8 years of age require 2 to 3 servings of dairy products or equivalent per day. Adolescents require 4 servings per day.

• **2015 Dietary Guidelines for Americans:**
  “Research has linked dairy intake to improved bone health, especially in children and adolescents.”

• **National Osteoporosis Foundation:** *Childhood and young adulthood are the bone building years; provide a well-balanced diet with adequate calcium-rich foods like milk, yogurt, plus 60 minutes per day moderate exercise*
Calcium, Vitamin D, and Dairy Receive High Grades for Bone Health in National Osteoporosis Foundation Review

- The review was conducted on scientific articles published between 2000 and 2014 that focused on dietary and lifestyle factors related to bone mass and strength in children and adolescents.

- Calcium and physical activity both received a grade of “A”.

- Dairy and vitamin D both received a grade of “B”.

- These were the highest scores awarded for any nutrient, food, or lifestyle factor.
Whey Protein Can Increase Muscle Protein Synthesis and Lean Body Mass Following Exercise

• Short-term effects:
  • Whey protein increase muscle protein synthesis at higher rate than soy and casein proteins following resistance exercise\(^1\)

• Longer-term effects:
  • Whey supplementation resulted in greater lean body mass after resistance training in young adults compared to soy protein or carbohydrate control\(^2\)
Dairy Proteins Help Maintain Muscle Function in Elderly

Muscle protein synthesis is enhanced with increasing doses of *whey protein* but not enhanced with soy protein in aged men

_Yang et al. Nutr & Metab 2012, 9: 57_

Whey protein supplementation and resistance training significantly increased peak power versus control

_Chale et al., 2012, J of Gerontology_

MPC supplementation improves physical performance, but does not increase muscle mass in frail elderly people

_Tieland et al., JAMDA. 2012 Oct;13(8):720-6_

*NDC sponsored study*
Health & Nutrition of Dairy: State of the Science Summary

• Nutrition/health are one dimension of an evolving story about global sustainable food systems, and their ability to promote human and environmental health in the face of a growing global population

• Dairy can improve human health, but also has positive implications for the social and economic dimensions of sustainable food systems, and an improving environmental impact as well

• Dairy contains many shortfall nutrients, and is a source of one of the highest quality proteins in the human diet

• Dairy food consumption – regardless of fat content – has increasingly been shown to have no adverse impact on cardiovascular disease risk, and may have positive effect in many instances

• The dairy matrix may impart health benefits that no single nutrient can provide, strongly suggesting that the whole is stronger than the sum of its parts
• Dairy food intake is associated with lower risk of Type 2 diabetes and hypertension. Dairy is also associated with better bone mineral density in children and adolescents.

• Several nutrients and bioactive components in dairy have been shown to reduce inflammation which, in turn, may improve immune function.

• The probiotics in yogurt and fermented dairy products may have unique health benefits that lower disease risk and promote health.

• Dairy proteins can increase muscle protein synthesis after exercise, as well as help maintain muscle function in elderly.

• Dairy foods are an integral part of sustainable food systems.