SMART DAIRY FOODS

Ian Givens
Institute for Food, Nutrition and Health
University of Reading

19 Nov 2018
CHILDREN: IMPACT OF DAIRY FOODS
Substantial and vulnerable sections of the UK population do not have food security now!

Around 4 million adults in the UK struggle to put food on the table. About 10 percent of children in the UK are living in households affected by severe food insecurity.
UK childhood obesity in England

Age 4-5
- Overweight: 10% (Boys), 9% (Girls)
- Obese: 13% (Boys), 13% (Girls)

Age 10-11
- Overweight: 22% (Boys), 18% (Girls)
- Obese: 14% (Boys), 14% (Girls)

Age 4-5:
- 2006/07: 12% (Most Deprived), 13% (Least Deprived)
- 2016/17: 8% (Most Deprived), 7% (Least Deprived)

Age 10-11:
- Most Deprived: 21%
- Least Deprived: 13%
**REVIEW**

Long-term association between dairy consumption and risk of childhood obesity: a systematic review and meta-analysis of prospective cohort studies

L Lu\(^1,2,3,4\), P Xun\(^5\), Y Wan\(^2\), K He\(^5,7\) and W Cai\(^1,3,4,6,7\)

<table>
<thead>
<tr>
<th>Study</th>
<th>Exposure</th>
<th>OR (95% CI)</th>
<th>Weight, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest vs. Lowest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scharf, 2013</td>
<td>Milk</td>
<td>0.64 (0.42, 0.97)</td>
<td>34.64</td>
</tr>
<tr>
<td>Bigornia, 2014</td>
<td>Full-fat dairy products</td>
<td>0.74 (0.43, 1.28)</td>
<td>20.96</td>
</tr>
<tr>
<td>Bigornia, 2014</td>
<td>Reduced-fat dairy products</td>
<td>0.57 (0.34, 0.95)</td>
<td>24.12</td>
</tr>
<tr>
<td>Bigornia, 2014</td>
<td>Total dairy products</td>
<td>0.56 (0.32, 0.97)</td>
<td>20.28</td>
</tr>
<tr>
<td>Test for heterogeneity ((I^2 = 0.0%, P = 0.88))</td>
<td></td>
<td>0.62 (0.49, 0.80)</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Choice of foods and ingredients for moderately malnourished children 6 months to 5 years of age

Kim F. Michaelsen, Camilla Hoppe, Nanna Roos, Pernille Kaestel, Maria Stougaard, Lotte Lauritzen, Christian Mølgaard, Tsinuel Girma, and Henrik Friis

Other studies, from both industrialized and from developing countries, have suggested that milk has a specific stimulating effect on linear growth [270]. Observational and intervention studies from industrialized countries suggest that intake of cow’s milk stimulates insulin-like growth factor 1 (IGF-1) secretion, which has a direct effect on linear growth [271, 272]. Equivalent amounts of protein in meat did not have an effect on IGF-1 levels [272].

Many studies have shown an impact of childhood malnutrition on cognitive function, physical activity, and school attendance and performance. Positive associations have been found between intake of animal-source foods and cognitive performance and verbalization in toddlers [273, 274], and school-age children

TABLE 22. Characteristics of animal foods compared with plant foods to which the beneficial effects can be attributed

<table>
<thead>
<tr>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher content of micronutrients</td>
</tr>
<tr>
<td>important for growth and cognitive development</td>
</tr>
<tr>
<td>(e.g., zinc, iron, and vitamin B&lt;sub&gt;12&lt;/sub&gt;)</td>
</tr>
<tr>
<td>Higher protein content and protein quality</td>
</tr>
<tr>
<td>No antinutrients</td>
</tr>
<tr>
<td>High energy density</td>
</tr>
<tr>
<td>High fat content</td>
</tr>
<tr>
<td>Higher content of n-3 PUFA</td>
</tr>
<tr>
<td>PUFA, polyunsaturated fatty acid</td>
</tr>
</tbody>
</table>
Hydroxaluria and Genitourinary Disorders in Children Ingesting Almond Milk Products

Demetrius Ellis, MD¹, and Jessica Lieb, RD, LDN²

We describe 3 children presenting with hematuria, dysuria or kidney stones, and hydroxaluria believed to be related to ingestion of excessive amounts of almond milk products. Our investigation of the oxalate content of several popular plant-based milk substitutes indicates that almond milk products are a particularly rich source of dietary oxalate. All genitourinary and urinary metabolic disturbances resolved after discontinuation of almond milk products.

Consequences nutritionnelles de l'utilisation de boissons végétales inadaptées chez les nourrissons de moins d'un an

Severe nutritional deficiencies in young infants with inappropriate plant milk consumption

B. Le Louer¹, J. Lemale¹,*, K. Garcette¹, C. Orzechowski², A. Chalvon³, J.-P. Girardet¹, P. Tounian¹

¹Service de nutrition et gastroentérologie pédiatriques, centre hospitalier universitaire Trousseau, hôpital Armand-Trousseau, AP-HP, 26, avenue du Dr-Arnold-Netter, 75571 Paris cedex, France
²Hôpital Saint-Camille, 94360 Bry-sur-Marne, France
³Centre hospitalier de Logny-sur-Marne, 77600 Logny, France
Sub-optimal vitamin D status across Europe


UK childhood rickets
Dairy and nutrient supply in teenage years and in pregnancy
Micronutrient intake of UK teenagers and adult females

NDNS 2014, Y1-4 combined

%<LRNI

Fe  Ca  Mg  Zn  Se  I

Females 11-18y
Females 19-64y
Males 11-18y

NDNS 2018, Y5-8 combined
Dairy food intake in UK females

NDNS 2014, Y1-4 combined

Age range

Intake (g/d)

- Milk
- Cheese
- Yoghurt

UK MILK PURCHASES 1974-2008 (ml/d)
Bone mass changes with age

Weaver et al. (2016)
A review of the iodine status of UK pregnant women and its implications for the offspring

Sarah C. Bath and Margaret P. Rayman
Department of Nutritional Sciences, School of Biosciences and Medicine, Faculty of Health and Medical Sciences, University of Surrey, Guildford GU2 7XH, UK

<table>
<thead>
<tr>
<th>Study</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation R Study, Netherlands</strong></td>
<td>Children born to mothers with low iodine: creatinine &lt;136μg/g in early pregnancy had mild alterations in executive functioning at 4 y of age (n=692) van Mil et al, (2012)</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>9 y old children, whose mothers had a gestational UIC &lt;150μg/L throughout pregnancy, had poorer language skills (n=228) Hynes et al, (2013)</td>
</tr>
<tr>
<td><strong>ALSPAC Study, UK</strong></td>
<td>Follow-up of 8-9 y old children found those whose mothers with urinary iodine:creatinine &lt;150μg/g in their first trimester had lower IQ and reading skills (n=1040) Bath et al, (2013)</td>
</tr>
</tbody>
</table>
Effect of factors on iodine concentration of UK retail milk 2015

Stevenson et al. (2018)
DIET AND CARDIOMETABOLIC HEALTH: IMPACT OF DAIRY FOODS
Recent meta-analyses of prospective studies on dairy and cardiometabolic diseases

<table>
<thead>
<tr>
<th>Dairy</th>
<th>Outcome</th>
<th>RR (95% CI)</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>AC mortality</td>
<td>1.00 (0.93-1.07)</td>
<td>Guo et al., 2017</td>
</tr>
<tr>
<td>Milk</td>
<td>CVD</td>
<td>1.01 (0.93-1.10)</td>
<td>Guo et al., 2017</td>
</tr>
<tr>
<td>Cheese</td>
<td>CVD</td>
<td>0.98 (0.95-1.00)</td>
<td>Guo et al., 2017</td>
</tr>
<tr>
<td>Milk</td>
<td>Stroke</td>
<td>0.93 (0.88-0.98)</td>
<td>De Goede et al., 2016</td>
</tr>
<tr>
<td>Cheese /40 g/d</td>
<td>Stroke</td>
<td>0.97 (0.94-1.01)</td>
<td>De Goede et al., 2016</td>
</tr>
<tr>
<td>Yoghurt/80g/d</td>
<td>Diabetes</td>
<td>0.86 (0.83-0.90)</td>
<td>Gijsbers et al., 2016</td>
</tr>
</tbody>
</table>
Association of dairy intake with cardiovascular disease and mortality in 21 countries from five continents (PURE): a prospective cohort study

Mahshid Dehghan, Andrew Mente, Sumathy Rangarajan, Patrick Sheridan, Viswanathan Mohan, Romaina Iqbal, Rajeev Gupta, Scott Lear, Edelweiss Wentzel-Viljoen, Alvaro Avezum, Patricio Lopez-Jaramillo, Prem Mony, Ravi Prasad Varma, Rajesh Kumar, Jephath Chifamba, Khalid F Alhabib, Noushin Mohammadifard, Aytekin Oguz, Fernando Lanas, Dorota Rozanska, Kristina Bengtsson Bostrom, Khalid Yusoff, Lungiswa P Tsolkile, Antonio Dans, AzfalHussein Yusufali, Andres Orlandini, Paul Poirier, Rasha Khatib, Bo Hu, Li Wei, Lu Yin, Ai Deeraili, Karen Yeates, Rita Yusuf, Noorhassim Ismail, Dariush Mozaffarian, Koon Teo, Sonia S Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators*

Methods The Prospective Urban Rural Epidemiology (PURE) study is a large multinational cohort study of individuals aged 35–70 years enrolled from 21 countries in five continents. Dietary intakes of dairy products for 136384 individuals were recorded using country-specific validated food frequency questionnaires. Dairy products comprised milk, yoghurt, and cheese. We further grouped these foods into whole-fat and low-fat dairy.

Interpretation Dairy consumption was associated with lower risk of mortality and major cardiovascular disease events in a diverse multinational cohort.
What about Saturated Fats and Cardiometabolic Diseases?

For many people dairy foods are the biggest source of SFA.
HRs (95% CIs) of CVD for SFA from dairy and meat

de Oliveira Otto et al. 2012
HR (95% CI) for associations between plasma PL SFA and incident T2 DM

EPIC-InterAct case-cohort
Forouhi et al., 2014

Even-chain SFA (16:0)

Odd-chain SFA

Long and very long-chain SFA
Changes in total and LDL-chol after consumption of ~80 g/d fat (~36g/d SFA) as cheese or butter.


Cheese vs butter ***P < 0.0001. ††††Significantly different from run-in period: † P < 0.05, ††† P < 0.0005.
Milk proteins and blood lipids

Fekete et al., AJCN (2016)

Δ baseline (mmol/L)

-0.2
-0.15
-0.1
-0.05
0
0.05
0.1

TC LDL-C TAG

Whey protein
Ca-caseinate
Control

a
b
ab

a,b different = P<0.05
Milk proteins and blood pressure

Peripheral SBP & DBP

$p=0.023$

$p=0.002$

Central SBP & DBP

Overall treatment effect for C_SBP $p=0.010$,
Overall treatment effect for C_DP $p=0.094$,
Overall treatment effect for C_MeanP $p=0.024$

$n=38$, Means ± SEM

$n=38$, Means ± SEM
Dairy intake and augmentation index
~25 years prospective study (Caerphilly)

Livingstone et al., 2013

Pulse wave velocity
\[ PWV = \frac{\Delta L}{\Delta T} \text{ (m/s)} \]

1.8% lower

\[ P_{\text{trend}} = 0.021 \]
Carbohydrate-rich meal +/- whey protein on blood glucose in T2DM patients

Frid et al., 2005

\[ P, \text{Treat x time} = 0.022 \]
Component in common dairy foods may cut diabetes risk

For immediate release: Monday, December 20, 2010

Boston, MA – Scientists at the Harvard School of Public Health (HSPH) and collaborators from other institutions have identified a natural substance in dairy fat that may substantially reduce the risk of type 2 diabetes. The compound, trans-palmitoleic acid, is a fatty acid found in milk,
The lipid hypothesis and CVD

Astrup, 2018

SATURATED FAT

HIGH BLOOD CHOLESTEROL

LDL particle size and density

ATHEROSCLEROSIS

CVD
DIET AND THE ELDERLY: IMPACT OF DAIRY FOODS
Prevalence of malnutrition in UK elderly

Annual cost to UK health services £13-19 billion
Ageing is associated with a gradual loss of skeletal muscle mass.

Kind permission Dr Olly Witard
Whey is primarily responsible for the greater anabolic response to milk vs soya protein in elderly men.

Burd et al., 2009

Yang et al., 2012

Kind permission Dr Olly Witard
A few conclusions….

- There are issues and opportunities at all life stages.
- Despite a major SFA source, no evidence of increased CMD risk in high dairy consumers (butter?)
- Evidence for fermented dairy, notably yoghurt and reduced T2DM risk needs urgent attention.
- Predicting CVD/CMD risk from dietary SFA is complex and may easily mislead.
- More attention is needed at the food/matrix level.
- Dairy foods can indeed be smart but they are not all the same.
- Solutions will require collaboration with milk processors/dairy food manufacturers.