

Case study

Risk-benefit assessment

of raw milk

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<http://zestandzng.com.au/make-the-switch-to-a2-milk/>

Why do people choose raw milk (RM)?

*“... trend toward **more natural products**. there seems to be an increasing preference for raw milk consumption as raw milk is associated with several **perceived health benefits** that are believed to be destroyed upon heating...”*

*“consuming **natural**”*

*“purchasing **locally**”*

*“... **perception that heating destroys the nutritional and health benefits of milk**. and can even induce some detrimental effects ...”*



A Campaign for Real Milk

A Project of the Weston A. Price Foundation



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Why A Campaign for Real Milk?

Back in the 1970s, a couple of blokes were sitting in an English pub, bemoaning the consolidation of the brewing industry in England and the decline of British beer and ale. A commodity that represented the soul of Britain—carefully brewed lagers from countless small-scale manufacturers, each with a distinctive color and taste—had been edged out by the insipid canned beers of a few large monopolistic breweries. What was needed, they decided, was a return to traditional brewing methods. They launched *A Campaign for Real Ale*, which soon became the force that turned back the mega-brewers and reinstated varied and delicious ales to English tables and pubs.

Back in the 1920s, Americans could buy fresh raw whole milk, real clabber and buttermilk, luscious naturally yellow butter, many kinds of fresh and aged cheeses, and cream in various thicknesses. Today's milk is accused of causing everything from allergies to cancer, but when Americans could buy Real Milk, these diseases were rare. In fact, Americans considered a supply of high-quality dairy products vital to American security and the economic well-being of the nation.

What's needed today is a return to humane, pasture-based dairying, small-scale traditional processing and direct farm-to-consumer sales, in short . . .

A Campaign for *Real Milk*.

Real Milk Nature's Perfect Food

Galen, Hippocrates, Pliny, Varro, Marcellus Empiricus, Bacchis and Anthimus, leading physicians of their day, all used raw milk in the treatment of disease. During the 1920s, Dr. J. E. Crewe of the Mayo Foundation used a diet of raw milk to cure TB, edema, heart failure, high blood pressure, prostate disease, urinary tract infections, diabetes, kidney disease, chronic fatigue and obesity. Today, in Germany, successful raw milk therapy is provided in many hospitals.

Studies show that children fed raw milk have more resistance to TB than children fed pasteurized milk (*Lancet*, p 1142, 5/8/37); that raw milk is very effective in preventing scurvy and protecting against flu, diphtheria and pneumonia (*Am J Dis Child*, Nov 1917); that raw milk prevents tooth decay, even in children who eat a lot of sugar (*Lancet*, p 1142, 5/8/37); that raw milk is better than pasteurized milk in promoting growth and calcium absorption (*Ohio Agricultural Experiment Station Bulletin* 518, p 8, 1/33); that a substance present in raw cream (but not in pasteurized cream) prevents joint stiffness and the pain of arthritis (*Annual Review of Biochemistry*, 18:435, 1944); and that children who drink raw milk have fewer allergic skin problems and far less asthma than children who drink pasteurized milk (*Lancet* 2001 358(9288):1129-33).

Contributions to A Campaign for *Real Milk* help pay for legislative action and the legal expenses of raw-milk dairy farmers. Send a donation and we'll send you brochures to give to your colleagues and friends.

A Campaign for

Real Milk

PASTURE-FED UNPROCESSED FULL-FAT



A Campaign for *Real Milk* is a project of
The Weston A. Price Foundation
PMB 106-380, 4200 Wisconsin Avenue, NW
Washington, DC 20016

For sources of *Real Milk* call (202) 363-4394 or visit www.realmilk.com

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Real Milk comes from real cows.

The source of most commercial milk is the modern Holstein, bred to produce huge quantities of milk—three times as much as the old-fashioned cow. She needs high-protein feed and antibiotics to keep her well. Her milk contains high levels of growth hormone from her pituitary gland, even when she is spared the indignities of genetically engineered Bovine Growth Hormone to push her to the upper limits of milk production.

**Join A Campaign for Real Milk.
Buy only milk from old-fashioned cows
such as Jerseys and Guernseys.**

Real Milk comes from real cows that eat real feed.

Real feed for cows is green grass in spring, summer and fall; green feed, silage, hay and root vegetables in winter. It is not soy meal, cottonseed meal or other commercial feeds, nor is it bakery waste, chicken manure, swill from ethanol production or citrus peel cake, laced with pesticides. Vital nutrients like vitamins A and D, and the "Price Factor" (a fat-soluble catalyst that promotes optimum mineral assimilation) are greatest in milk from cows eating green grass, especially rapidly growing green grass in the spring and fall. Vitamins A and D are greatly diminished, and the Price Factor disappears when milk cows are fed commercial feed. Soy meal has the wrong protein profile for the dairy cow, resulting in a short burst of high milk production followed by premature death. Most milk (even most milk labeled "organic") comes from dairy cows that are kept in confinement their entire lives and never see green grass!

**Join A Campaign for Real Milk.
Buy milk products
only from herds allowed
to graze on green pasture.**

Real Milk is not pasteurized.

Pasteurization destroys enzymes, diminishes vitamin content, denatures fragile milk proteins, destroys vitamins C, B₁₂ and B₆, kills beneficial bacteria, promotes pathogens and is associated with allergies, increased tooth decay, colic in infants, growth problems in children, osteoporosis, arthritis and heart disease. Calves fed pasteurized milk do poorly and many die before maturity. Raw milk sours naturally but pasteurized milk turns putrid. Inspection of dairy herds for disease is not required for pasteurized milk. Pasteurization was instituted in the 1920s to combat TB, infant diarrhea, undulant fever and other diseases caused by poor animal nutrition and dirty production methods. But times have changed and modern stainless steel tanks, milking machines, refrigerated trucks and improved testing methods make pasteurization absolutely unnecessary for public protection. And pasteurization does not always kill pathogens. The bacteria for John's disease, with which most confinement cows are infected, survives pasteurization; it has been linked to Crohn's disease in humans. Much commercial milk is now ultra-pasteurized to get rid of heat-resistant pathogens and give it a longer shelf life. Ultra-pasteurization is a violent process that takes milk from a chilled temperature to above the boiling point in just a few seconds. Clean raw milk from certified healthy cows is available commercially in several states and may be bought directly from the farm or obtained through cow share programs in many more. (Sources are listed on www.realmilk.com.)

**Join A Campaign for Real Milk.
Demand access in all states to clean, raw milk.
Boycott processed milk!**

Real Milk is not homogenized.

Homogenization is a process that breaks down butterfat globules so they do not rise to the top. Homogenized milk has been linked to heart disease.

**Join A Campaign for Real Milk.
Use only milk with "Cream on the Top."**

Real Milk contains butterfat, and lots of it!

Average butterfat content from old-fashioned cows at the turn of the century was over 4% (or more than 50% of calories). Today butterfat comprises less than 3% (or less than 35% of calories). Worse, consumers has been duped into believing that low-fat and skim milk products are good for them. Only by marketing low-fat and skim milk as health foods can the modern dairy industry get rid of its excess poor-quality, low-fat milk from modern high-production herds. Butterfat contains vitamins A and D needed for assimilation of calcium and protein in the water fraction of the milk. Without them protein and calcium are more difficult to utilize and possibly toxic. Butterfat is rich in short- and medium-chain fatty acids, which protect against disease and stimulate the immune system. It contains glycosphingolipids, which prevent intestinal distress, and conjugated linoleic acid, which has strong anticancer properties.

**Join A Campaign for Real Milk.
Buy only full-fat milk products.**

Real Milk products contain no additives.

Powdered skim milk, a source of dangerous oxidized cholesterol and neurotoxic amino acids, is added to 1% and 2% milk. Low-fat yogurts and sour creams contain mucopolysaccharide slime to give them body. Pale butter from hay-fed cows contains colorings to imitate vitamin-rich butter from grass-fed cows. Bioengineered enzymes are used in large-scale cheese production. Mass-produced cheeses contain additives and colorings, and imitation cheese products contain vegetable oils.

**Join A Campaign for Real Milk.
Boycott Counterfeits!**

Real Milk can save family farms.

Pasteurization laws favor large, industrialized dairy operations and squeeze out small farmers. When farmers have the right to sell unprocessed milk directly to consumers, they can make a decent living, even with small herds.



<https://modernfarmer.com>

“Sale of raw drinking milk through **vending machines** is permitted in some Member States, but consumers are usually instructed to **boil the milk before consumption**” (EFSA)



Raw milk vending machine in Slovenia



Raw milk vending machine in France

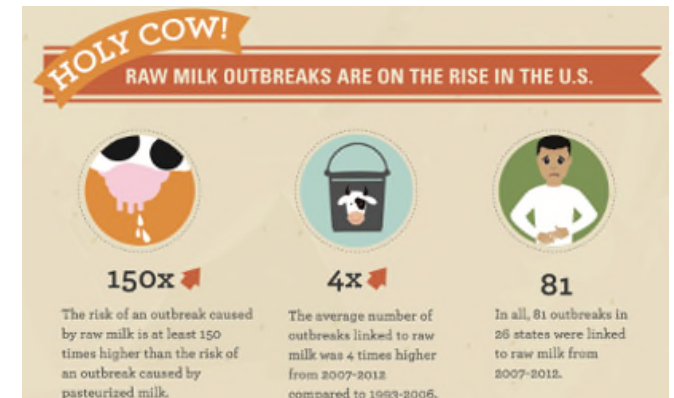
<https://modernfarmer.com>

Outbreaks

- In ~ 1 - 6% of the human outbreaks reported in **developed countries**, milk products have been identified as the vehicle of infection
 - 39.1% attributed to **milk**
 - 53.1% to **cheese**
 - 7.8% to **other milk products**

(De Buyser, Dufour, Maire, & Lafarge, 2001; EFSA, 2010; Gillespie, Adak, O'Brien, & Bolton, 2003; Headrick et al., 1998; Lee & Middleton, 2003)

- 2007 – 2012: 27 reported **outbreaks in the EU involving RM**:
 - 21 due to *Campylobacter* spp. (predominantly *C. jejuni*)
 - 1 due to *Salmonella* Typhimurium
 - 2 due to STEC
 - 3 due to Tick-borne encephalitis virus (TBEV)
 - 4 were due to raw milk from goats
 - 23 were due to raw milk from **cows**



Facts & Unsolved questions

- Milk & milk products could be associated to food-borne diseases – several reported outbreaks associating milk (RM) as a cause
- Previous studies assessing risk of RM consumption (QMRA *Campylobacter jejuni*, *Listeria monocytogenes* and STEC) – no DALYs calculation
- Few studies/reports comparing risks and benefits from RM, none presenting in a **quantitative** way
 - “...RM poses a **realistic and unnecessary** health threat because of its possible contamination with pathogenic bacteria...”

Facts & Unsolved questions

- Remaining unsolved questions:
 - What is the **balance between the associated risks and benefits** of RM? Is it possible to **quantify** them?
 - Are the presented arguments to consume RM based in scientific evidence?
 - Could they impact the health of consumers?

Raw Milk Case study



- A. Problem formulation
- B. Scenarios definition
- C. Food components & Health effects to be considered
- D. Microbiology – results for *Listeria monocytogenes*
- E. Nutrition – results for vitamin B2
- F. Integration of risks & benefits – scenarios comparison

A. Problem formulation

- Aims: to quantify **how healthy** or **risky** RM consumption could be
- Level of aggregation: **food product** → raw milk *versus* heat-treated milk (Pasteurized)
- Population of interest: **general population**

- RBQ:

What are the health effects associated to the consumption of raw drinking milk?

Is raw drinking milk healthy overall?

How healthy (DALY)?

B. Scenarios definition

Reference Scenario No consumption of raw drinking milk and consumption of heat-treated milk (100 % heat-treated milk) – Pasteurized milk

Alternative Scenario Consumption of raw drinking milk (100 % raw drinking milk).
consumed directly from the vending machine

Sub-scenarios were considered → **storage conditions**

- The health effects estimated considering the consumption of **1 cup of milk** (~240 mL)
- For microbiological risk assessment: consumption of 100.000 servings of raw milk/year was assumed


C. Which components should be considered?

1. Microbiology

2. Nutrition

3. Toxicology

4. Whole milk



Components that do **not present differences between raw and heat-treated** milk were not considered in this case study

Components identification

- Based on the:
 - hazard identification performed by **EFSA** in its Scientific Opinion on the public health risks related to the consumption of RM;
 - **international authorities** and regulatory agencies reports;
 - already **published studies** focusing on the risk assessment of RM consumption

1. Microbiology – Risks

- Included pathogens:

- *Campylobacter* spp.
- *Salmonella* spp.
- *Listeria monocytogenes*
- Shigatoxin-producing *Escherichia coli* (STEC)



Associated **outbreaks**
Detection in raw milk

- Not included pathogens:

- *Brucella melitensis*
- *Mycobacterium bovis*
- Flavivirus (Tick-borne Encephalitis Virus (TBEV))



Outbreak evidence **older**
 Official **control plans**
Other species than Cow

1. Microbiology – Benefits

- Probiotic bacteria:
 - Included: *Lactobacillus*
 - **Microflora** of raw milk
 - Not included: Bifidobacteria
 - Inhabitants of the **cow's intestines** not the udder
 - Presence of bifidobacteria in raw milk indicates **faecal contamination** and poor farm hygiene
- Other that were not included: bacteriocins (production limited under refrigeration), acid lactic bacteria (growth and acid lactic production limited under refrigeration)

2. Nutrition – Benefits

- Vitamins
 - Included: **Vitamins A** (milk as an **important source**) & **B2** (milk important **contributor for the daily intake**)
 - Not included: Vitamins B12, C & Folate (not important source)
- Proteins and Amino acids: were not included
 - **Other sources**
 - **No differences** between raw and heat-treated milk
- Fats: were not included
 - Heat treatment has **no effect on milk fat** amount or composition
 - **No clear evidence** between different doses/raw milk/health effect
- Minerals, lactose, milk enzymes, digestive enzymes, immunoglobulins: were not included

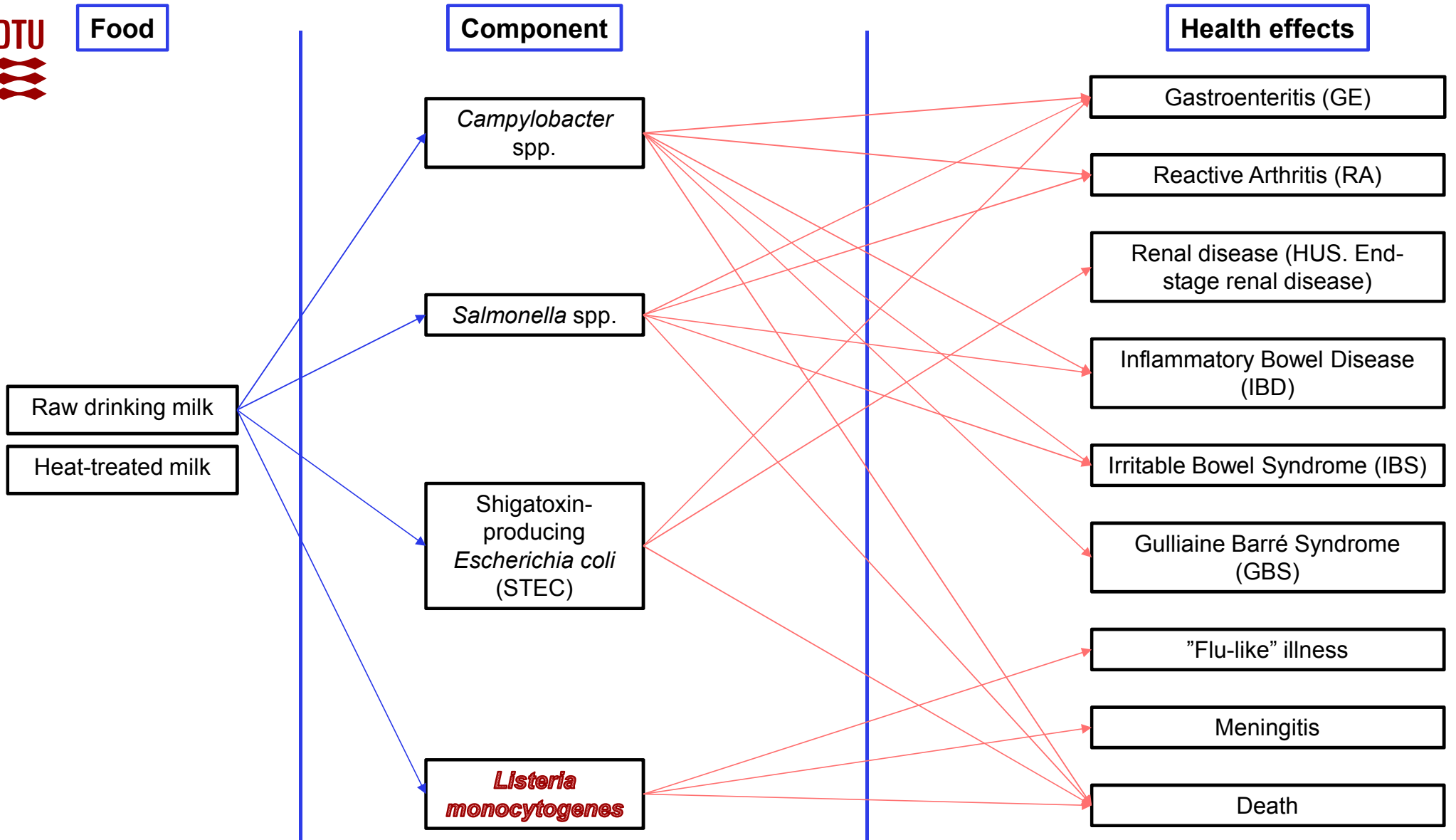
3. Toxicology

- Potentially:
 - Antibiotics residues
 - Mycotoxins (aflatoxins)
 - Other

No differences between RM and heat-treated milk are expected

4. Whole milk

- Consumption of whole milk: included
 - Decrease in the **prevalence of hay fever and asthma**
 - But, **mechanisms** underlying the protective farm milk effect is still **not fully understood**



Raw drinking milk
Heat-treated milk

Probiotic bacteria:
Lactobacillus

Small intestinal bacterial overgrowth (SIBO)

Irritable Bowel Syndrome (IBS)

Psychological symptoms

Reduction of fasting blood glucose levels/Type 2 diabetes mellitus

Respiratory tract infections in children/Acute upper respiratory tract infections

Reduction of serum lipid levels/Cardiovascular diseases

Food

Component

Health effects

Raw drinking milk
Heat-treated milk

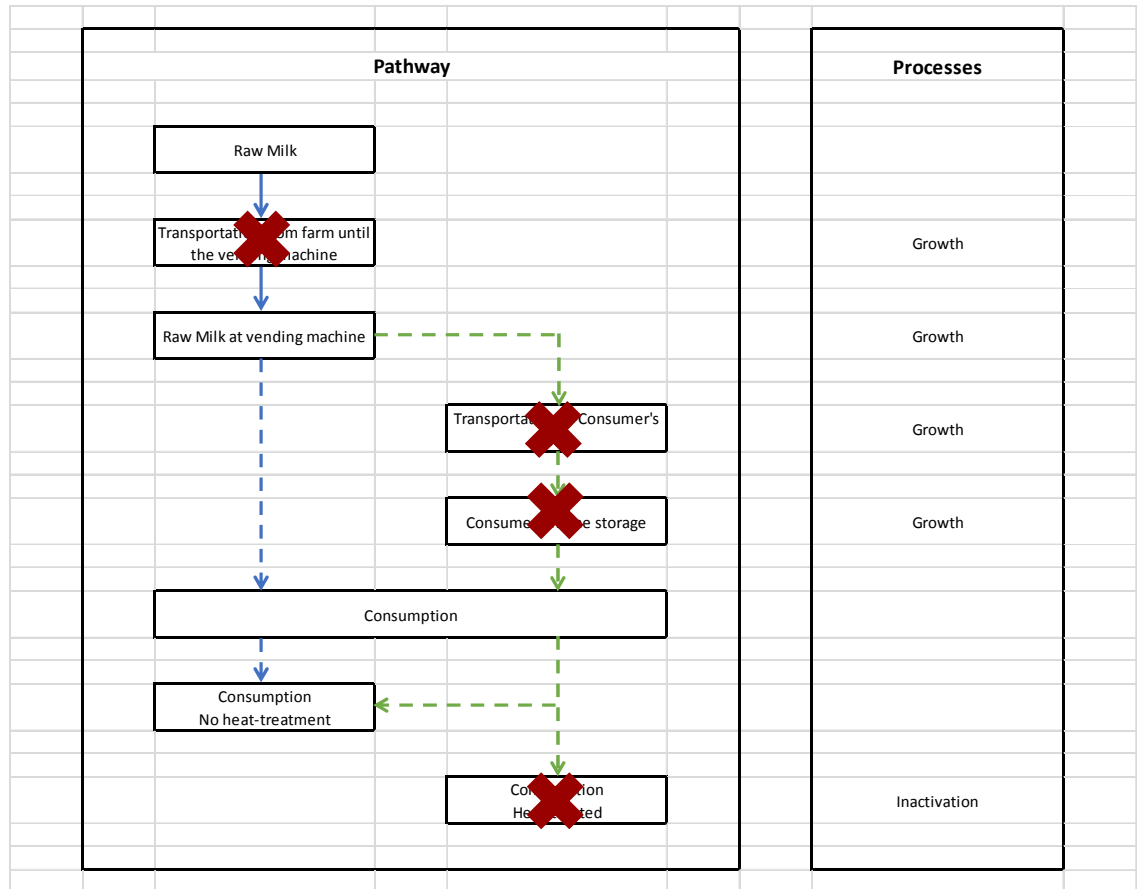
Vitamin B2

Vitamin A

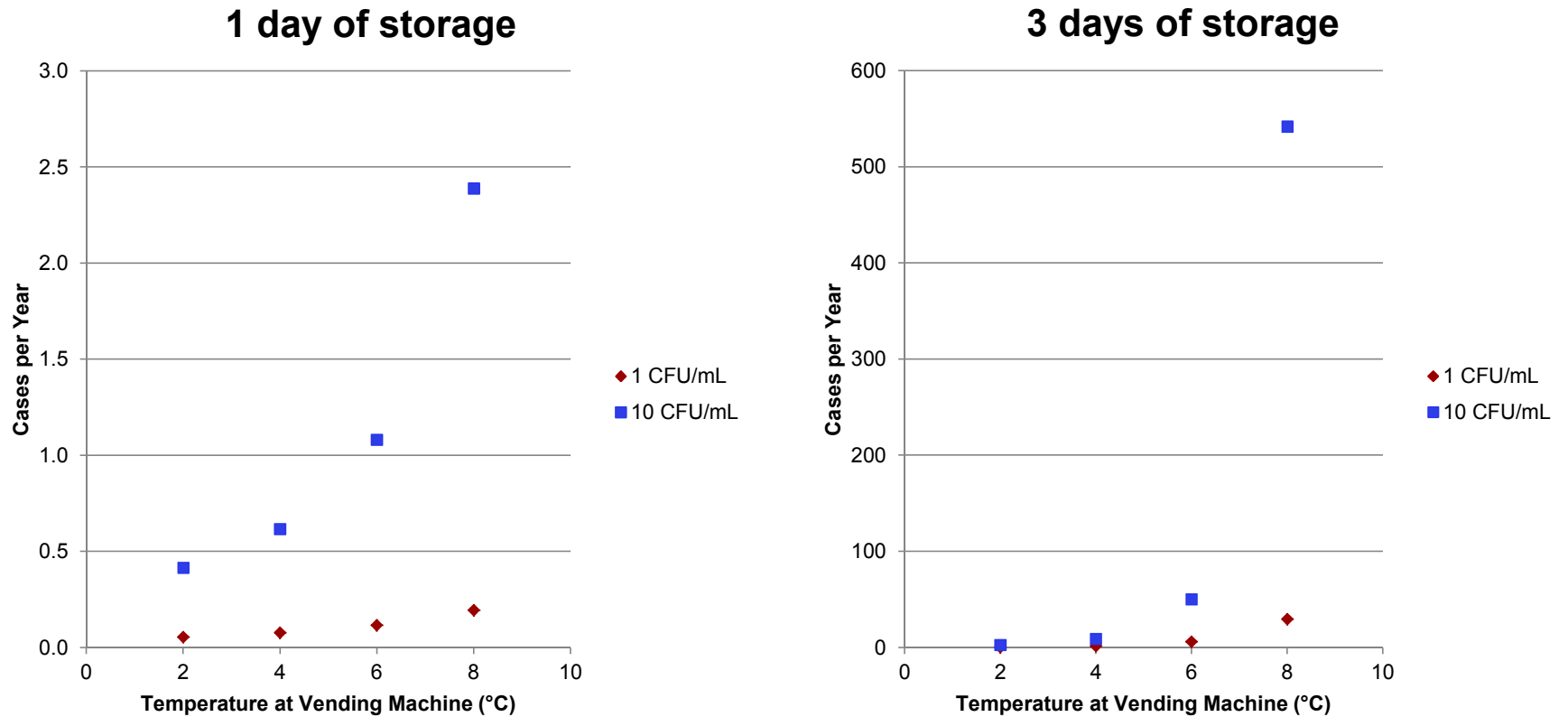
Colorectal cancer
Breast Cancer
Gastric Cancer
Renal damage
Asthma
Atopy
Hay fever
Visual System – Cataracts
Bone metabolism

D. Microbiology – results *Listeria monocytogenes*

- Risk assessment (*bottom-up approach*)
 - **No growth** during **transportation** to the vending machine
 - **Direct consumption** from the vending machine **without any heat treatment**
 - Different **storage conditions** at vending machine
 - 1 day, 3 days
 - 2 °C – 8 °C



Estimated number of cases of Listeriosis per year



Estimated DALYs associated to Listeriosis in RM

- DALY calculation: using BCoDE → **DALY per case**
- Consumers: 1 cup (1 serving) of milk per day per year
- **ΔDALYs**: Reference *versus* Alternative scenario



Initial value (CFU/mL)	Storage time at vending machine (Days)	Temperature at vending machine (°C)	DALY per year
1	1	2	0.000
		4	0.000
		6	0.000
		8	0.000
	3	2	0.005
		4	0.011
		6	0.039
		8	0.420
10	1	2	0.000
		4	0.005
		6	0.005
		8	0.011
	3	2	0.021
		4	0.091
		6	0.687
		8	7.632

E. Nutrition – results Vitamin B2

- Benefit assessment (*top-down approach*)
 - Exposure assessment based on *Dutch Food Composition Database*
 - Dose-response: fitting according to epidemiological data for **Colorectal cancer** & **Breast cancer**
 - **Potential impact fraction** (PIF) = $(RR_{alt} - RR_{ref}) / RR_{ref}$
 - DALYs Calculation: **DALY rate** (DALY per case) in Europe to Colorectal cancer and Breast cancer according to GBD results tool
 - **ΔDALYs**: Reference *versus* Alternative scenario



Change in DALYs: Raw Milk vs Pasteurized Milk

Health effect: colorectal cancer	Health effect: breast cancer		
Raw Milk vs Pasteurized Milk	Raw Milk vs Pasteurized Milk		
Δ DALY (DALYs/100k)	-3.40	Δ DALY (DALYs/100k)	-1.83
Δ DALY (DALYs/year)	-0.000034	Δ DALY (DALYs/year)	-0.000018

F. Integration of risks & benefits – scenarios comparison

				Vitamin B2	
				Colorectal Cancer & Breast Cancer	
	Initial value (CFU/mL)	Storage time at vending machine (Days)	Temperature at vending machine (°C)		
Listeriosis	1	1	2	-0.0001	~ 4.5 sec saved
			4	-0.0001	
			6	-0.0001	
			8	-0.0001	
		3	2	0.005	~ 10.0 h lost
			4	0.011	
			6	0.039	
			8	0.420	
	10	1	2	-0.0001	~ 16.5 h lost ~ 7.6 days lost
			4	0.005	
			6	0.005	
			8	0.011	
3		2	0.021		
		4	0.091		
		6	0.687		
		8	7.632		

Key messages – Raw Milk case study

- Considering only *Listeria monocytogenes* & Vitamin B2:
 - Overall the consumption of raw milk comparing to heat-treated milk presents **higher risk than benefit**
 - Maximum health loss (only including *Listeria monocytogenes*) ~ 8 days
 - Even considering any benefit, it would be residual (maximum of 4.5 seconds/year)
 - **Storage conditions** (time/temperature) & **Initial contamination**: critical risk aspects
 - Just **two components** were considered. What about the remaining components?

IT IS UP TO THE CONSUMER TO TAKE THE RISK!

Next steps...

- Include remaining pathogens (*Campylobacter* spp.; *Salmonella* spp.; STEC)
- Include Lactobacillus + Vitamin A + Whole Milk
- Integrate all risks & benefits (Δ DALYs)



DEADLINES

Welcome

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Sessions

Conference Programme

- Challenges in Risk Assessment
 - Session in Risk-Benefit Assessment

3rd International Conference on Food Contaminants Challenges on Risk Assessment

26, 27 SEPTEMBER 2019
Aveiro, Portugal

REGISTRATION

ABSTRACT SUBMISSION

Call for abstracts open!!!

Acknowledgments

- EU-FORA programme (EFSA)
- All my colleagues from the Research Group for Risk-Benefit (DTU Food)

You!