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Raw milk and health from a historical
and modern perspective

Leche cruda y salud desde una
perspectiva histórica y moderna.

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Raw milk and health from a historical and modern perspective

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Content

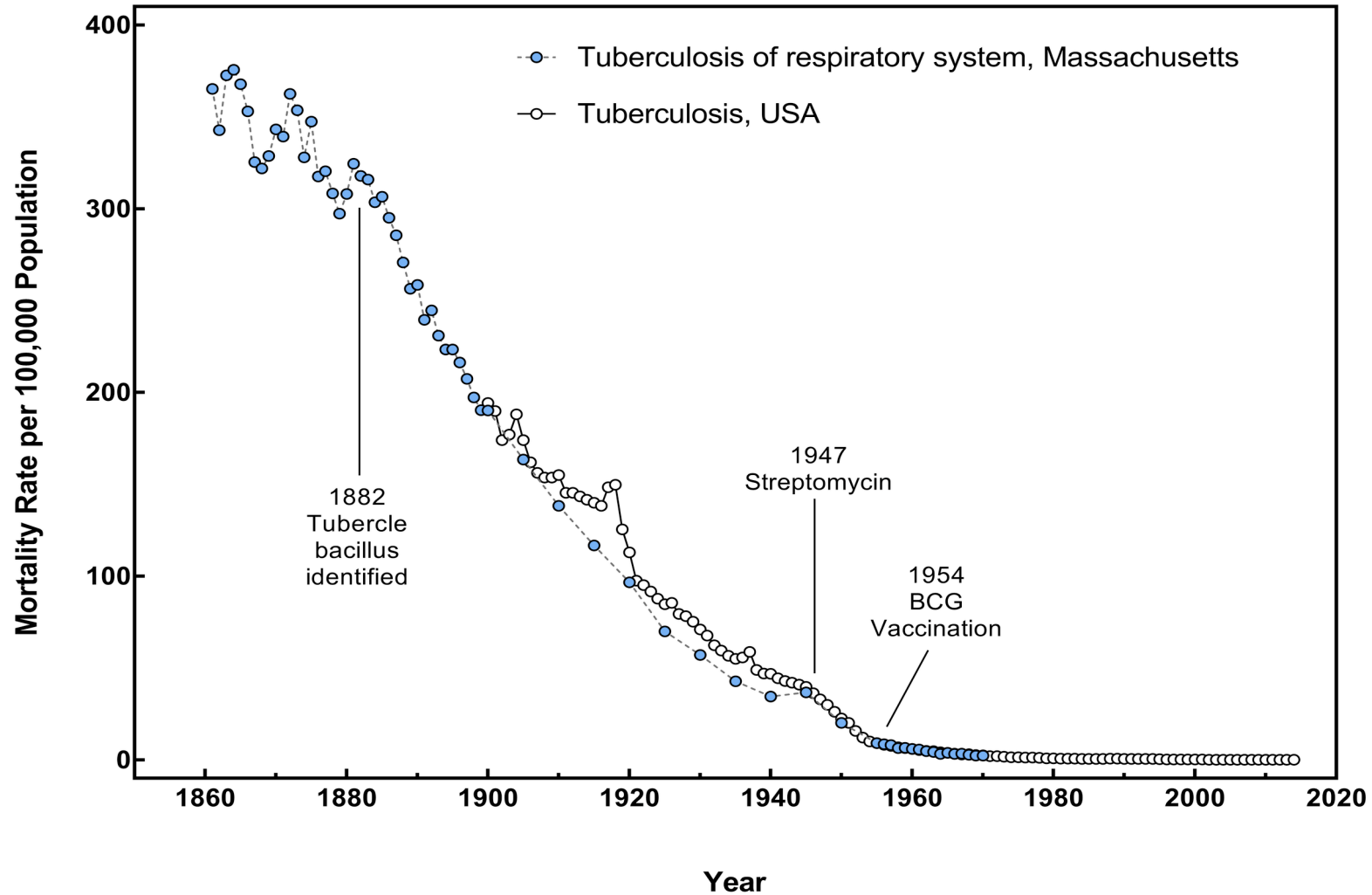
- Tuberculosis in children > two ways for protection
- Clinical trial in multiple allergic children, raw vs shop milk > raw milk protects
- Pre-clinical studies to understand mechanisms and immunology > heating induces unwanted false immunological answers in mice models
- Changes in the milk matrix after heating > critical temperatures to avoid
- Questionnaires in adults > people with a reduced immunity and poor health could increase their health most
- Future perspective



The need for reduction of infant mortality in the late 1900s



Tuberculosis mortality (Wikipedia)



Tubercle bacteria

- Man – man, man – cow, cow – man transmission
- Eradication of TB bacteria
- Pasteurisation as a temporary measure became a final measure due to longer shelf life of milk > industrial benefit



The boiled solution

- In Paris (1899) 46% of bottle fed babies died and only 5% of breast fed (Obladen, 2012)
- The start of Nutricia baby food according to the recipe of Prof. Dr. Backhaus in Göttingen (Germany)
- Boiled milk without casein (cheese processing) and additional sugars, sterilised in bottles



The raw solution: Vorzugsmilch since 1905, legal since 1930s



Testing multiple allergic children with raw biodynamic Vorzugsmilch



Human study (11 children): DBPCT

- Children were tested one by one (June 2009 – Nov 2010)
- 11 children were tested:
 - 2 children shows a negative SPT and could take up both shop and raw milk till 50 ml >> no milk allergy
- 9 children were left:
 - 6 males, 3 females
 - Age: 1.5 years
 - Tot IgE: 155 ku/l; Spec IgE: 10 ku/l
 - Raw vs shop milk: 50 ml vs 8.6 (range 0.5-50; SE = 16.0). P=0.002
 - No pathological reactions on raw milk
 - 1 child: no pathological reactions on shop milk, 8 children: increased rash, eczema, etc immediate or delayed



Oral milk provocation of multi-allergic children with raw and shop milk *(Abbring et al., 2019)*

TABLE 1 Organic raw cow's milk tolerated by cow's milk allergic children

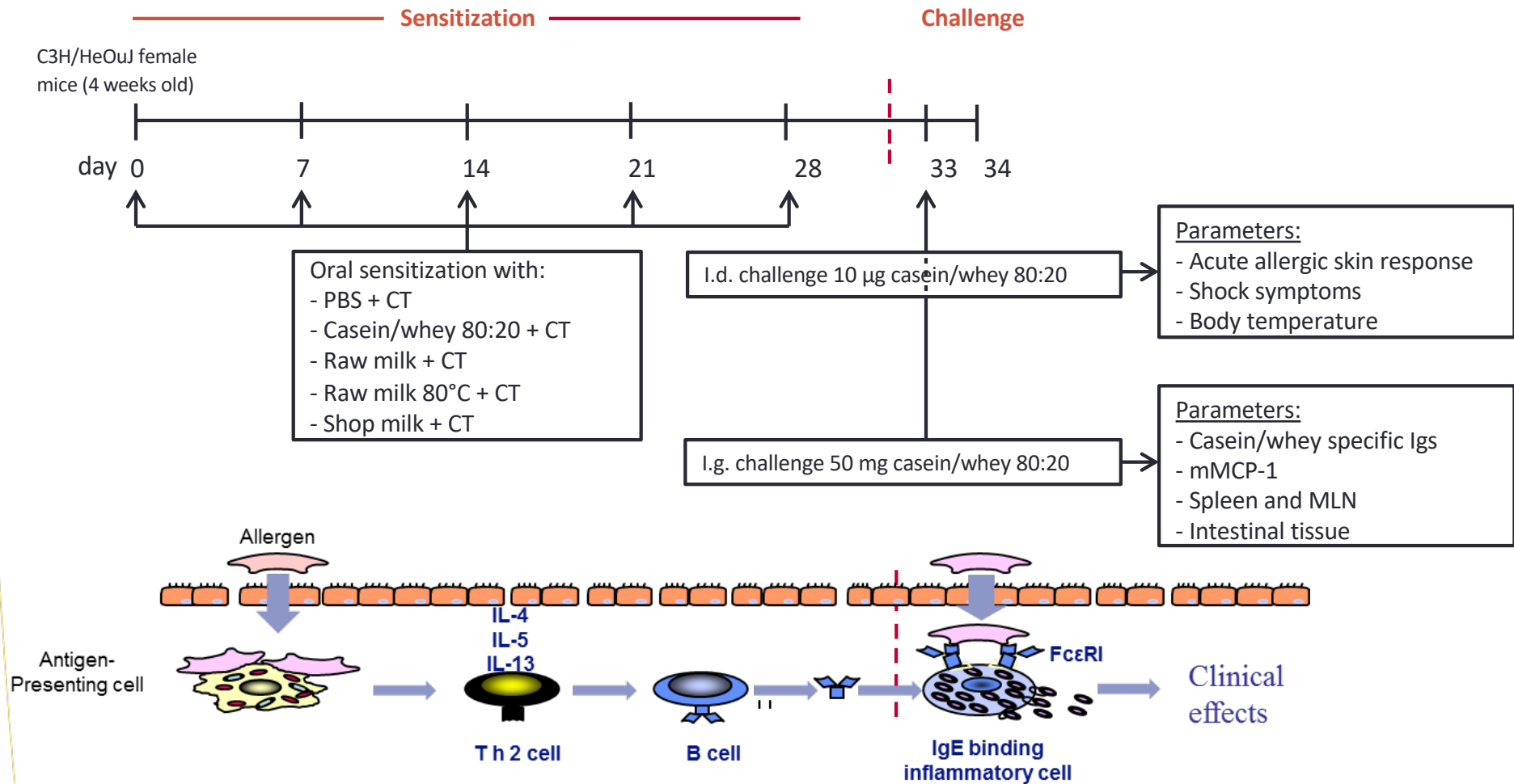
Patient	Gender	Age (y)	Skin		Serum		DBPCT	
			SPT (mm)	APT (class)	Total IgE (kU/L)	Specific IgE (kU/L)	Raw milk (mL)	Shop milk (mL)
1	M	2.65	10	++	322.0	26.3	50.0	2.0
2	M	3.52	4	++	123.0	4.2	50.0	10.0
3	M	0.55	7	+++	37.5	8.4	50.0	0.5
4	F	0.96	12	++	66.8	5.6	50.0	50.0
5	M	1.59	3	+++	nd	nd	50.0	1.0
6 ^a	M	1.65	0	+	nd	nd	50.0	50.0
7 ^a	M	1.09	0	+	nd	nd	50.0	50.0
8	M	0.96	5	++	98.6	12.4	50.0	0.5
9	F	0.83	7	+++	44.2	5.5	50.0	10.0
10	F	1.28	4	++	nd	nd	50.0	2.5
11	M	1.10	8	+++	nd	nd	50.0	1.0
Mean		1.49	6.7	2.4	115.4	10.4	50.0	8.6**
SEM		0.32	1.0	0.2	43.4	3.4	0.0	5.3



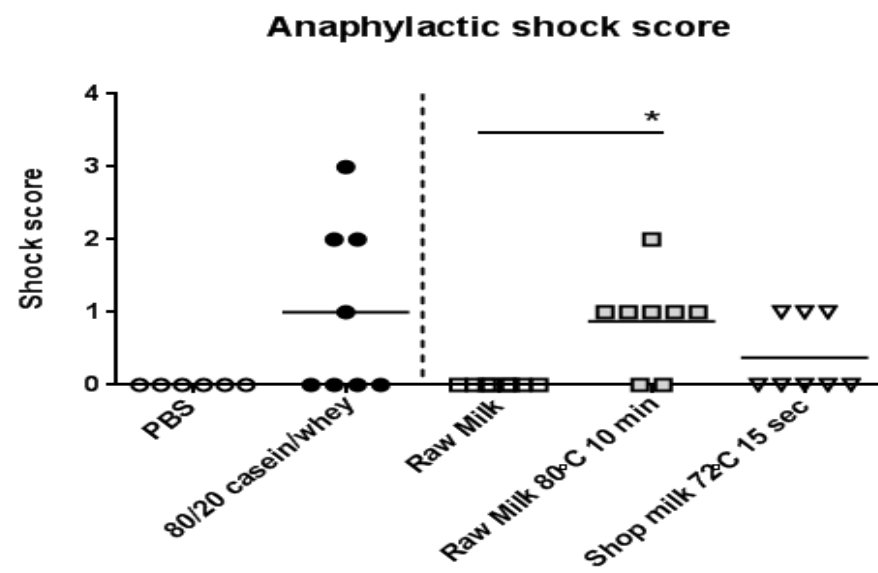
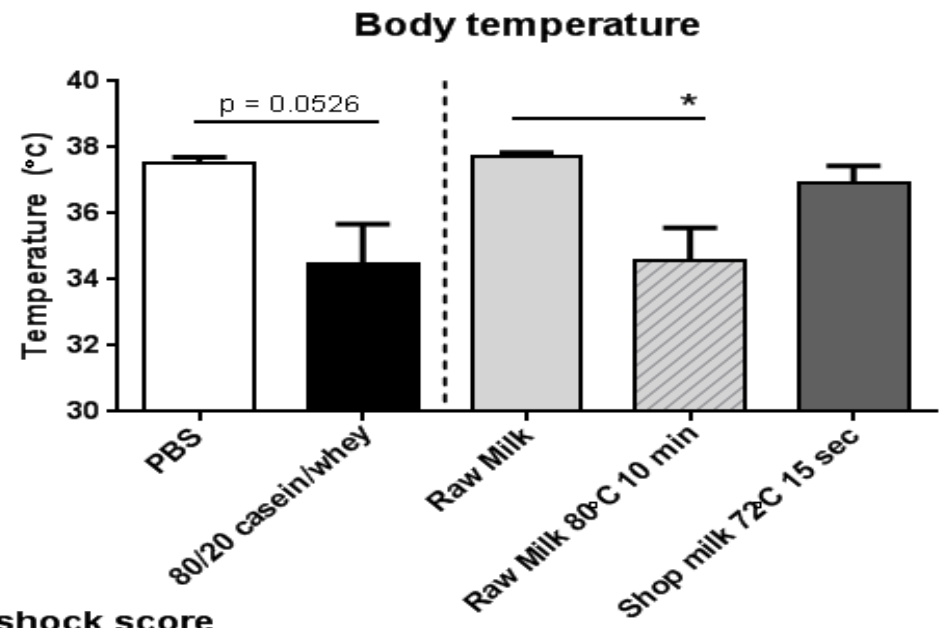
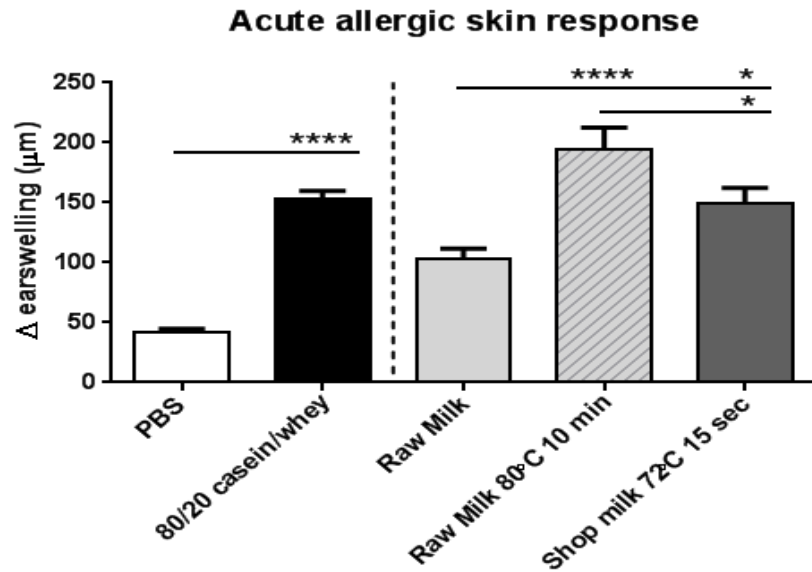
Preclinical experimental studies in mice based on Vorzugsmilch



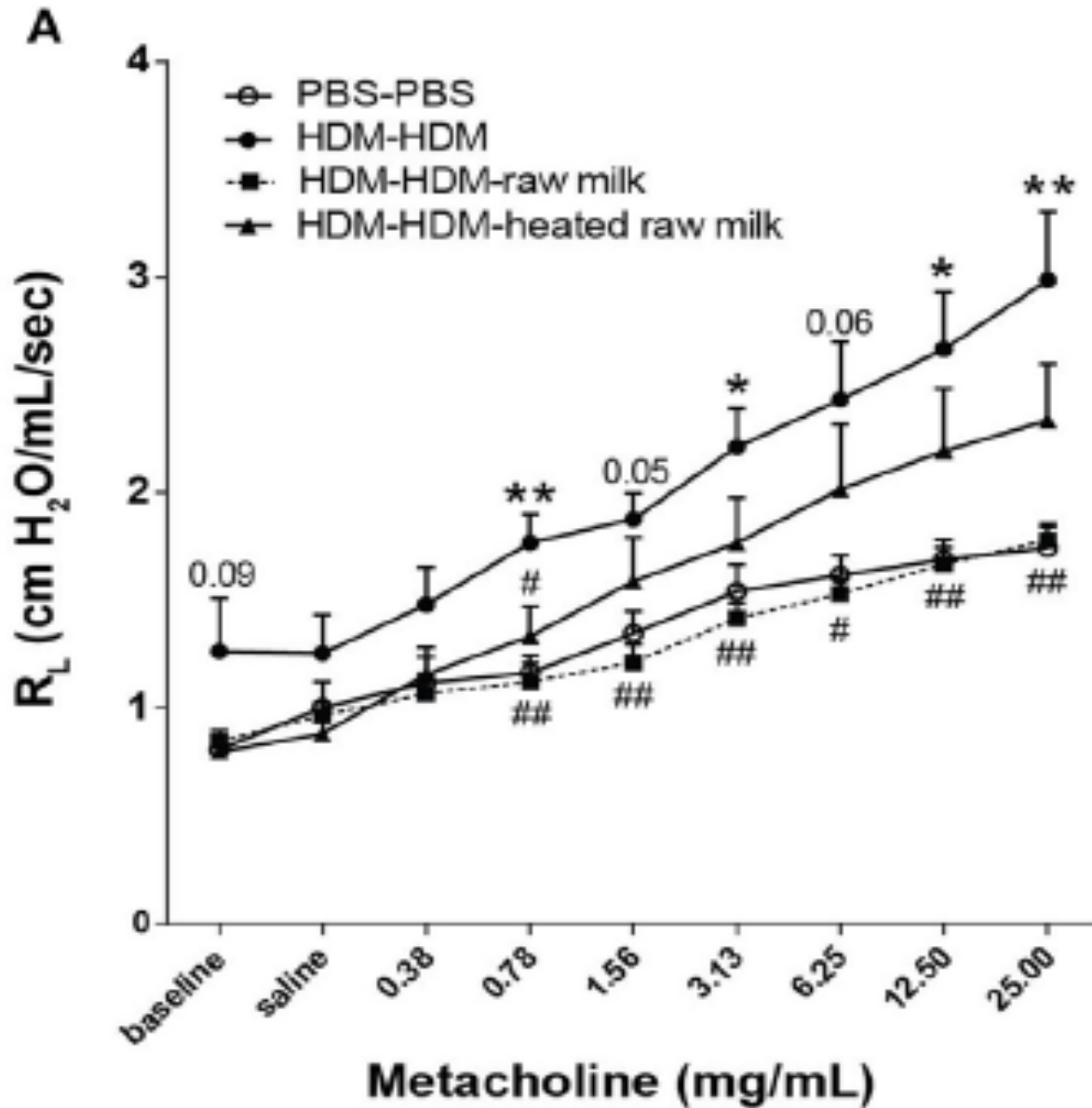
Timeline sensitisation in mice



Clinical outcomes *(Abbring et al., 2019)*



Raw milk in Asthma mice *(Abbring et al 2017)*



Positive control =
Asthma

80°C

Raw milk and
Negative control =
no Asthma

In between conclusions

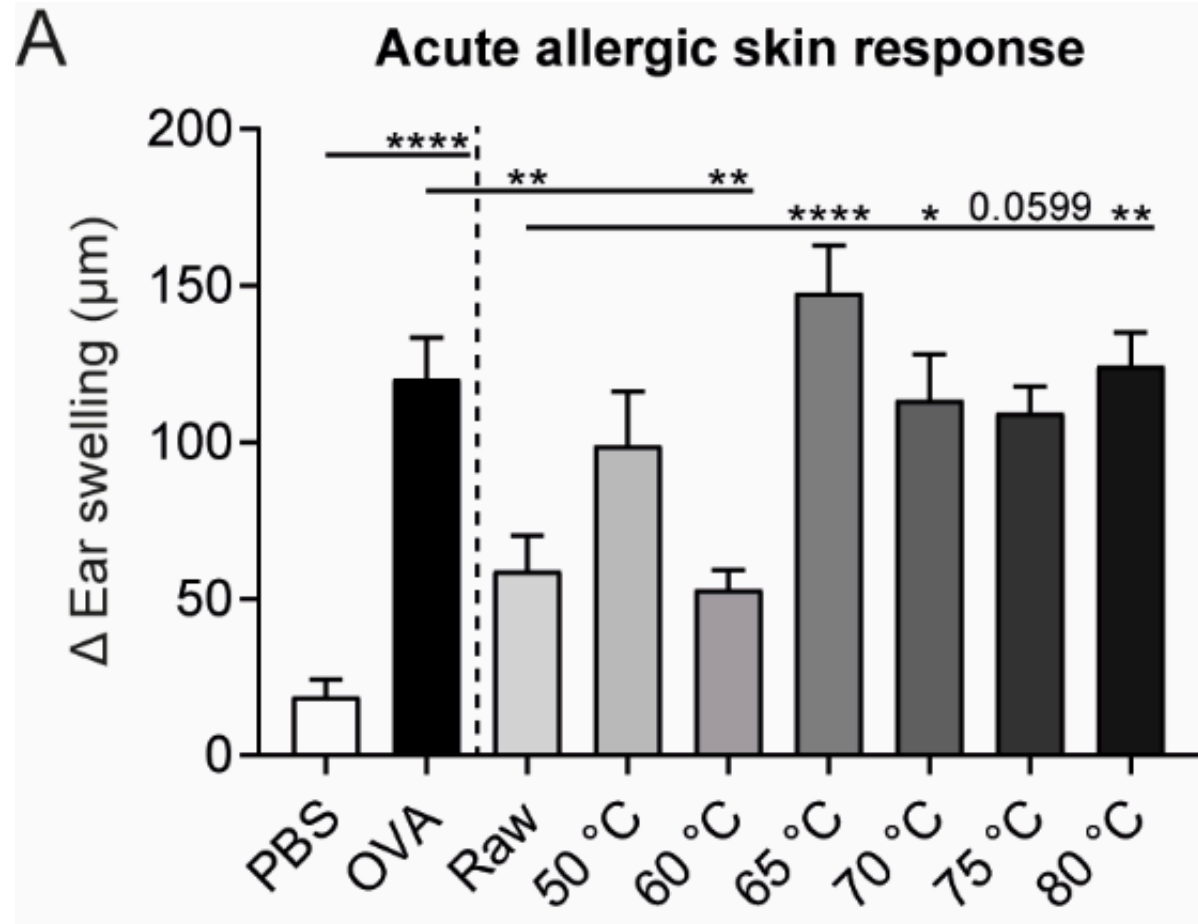
- Based on a wide range of epidemiological studies, the consumption of raw milk is found as a single protective factor for asthma and allergies (Braun-Fahrländer et al., 2010; Loss et al., 2011)
- In a clinical study in multiple allergic children raw milk could be tolerated, not processed shop milk (Abbring et al., 2019a)
- In a range of pre-clinical studies for food tolerance and sensitisation, raw milk does not impact the allergic outcomes, which are only generated if milk, milk whey, defatted milk was heat treated (Abbring et al., 2019b)
- In a pre-clinical study in asthma mice raw milk protected against asthma (Abbring et al., 2017)



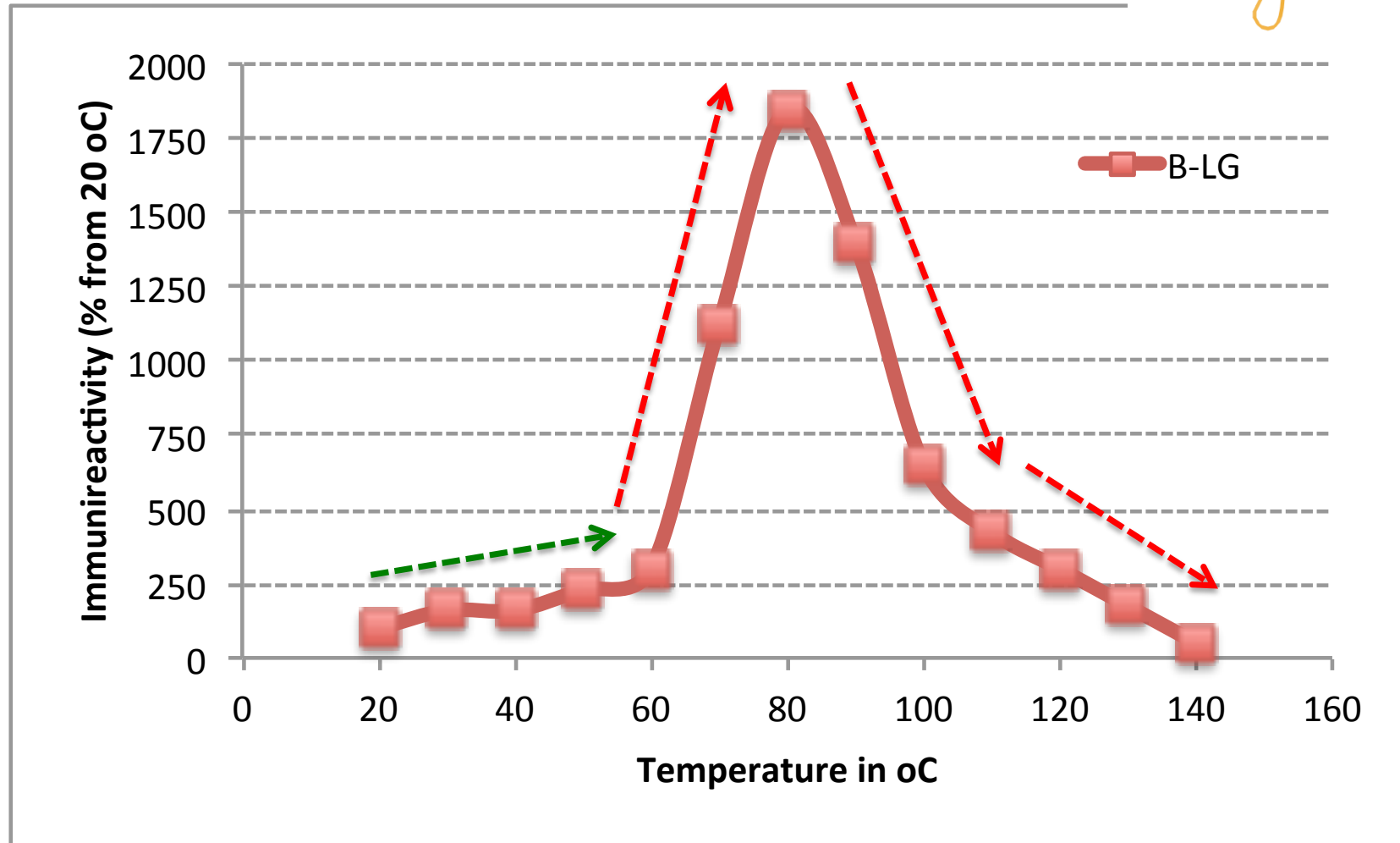
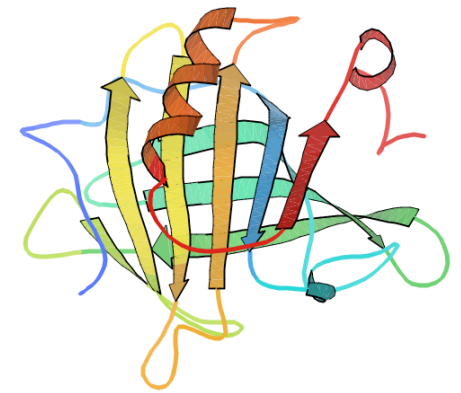
Changes in the milk matrix



Allergic response in mice (*Abbring unpublished*)



Immuno-reactivity Beta-lactoglobulin *(Karamonova et al., 2010)*



Changes in protein concentration after heat treatment *(Brick et al. 2017)*

Table 3. Significantly differing proteins between high and no/low heat treated milk-types with a change of $\geq 10\%$.

Protein Code	Number of Peptides	<i>p</i> -Value *	Log2 Fold Change (95% CI)	Protein Name	Protein Function
P80457	67	0.001	-0.44 (-0.56; -0.31)	Xanthine dehydrogenase/oxidase	immunity
P24627	71	0.004	-0.37 (-0.51; -0.22)	Lactoferrin	immunity
G3X6N3	57	0.006	-0.35 (-0.50; -0.20)	Serotransferrin	transport
F1MR22	42	0.004	-0.34 (-0.47; -0.21)	Polymeric immunoglobulin receptor	immunity
P80025	37	0.001	-0.33 (-0.43; -0.23)	Lactoperoxidase	immunity
G3N1R1	4	0.002	-0.32 (-0.44; -0.21)	Uncharacterized protein	unknown
F1MGU7	7	0.04	-0.30 (-0.52; -0.07)	Fibrinogen gamma-B chain	Blood coagulation
G3X7A5	80	0.002	-0.29 (-0.41; -0.18)	Complement C3	immunity
F1MZ96	10	0.002	-0.27 (-0.36; -0.18)	Uncharacterized protein	unknown
F1MX50	4	0.01	-0.27 (-0.40; -0.13)	Uncharacterized protein	cell
F1MM32	8	0.026	-0.26 (-0.43; -0.08)	Sulfhydryl oxidase	enzyme
P81265	42	0.006	-0.24 (-0.35; -0.14)	Polymeric immunoglobulin receptor	immunity
F1N076	12	0.001	-0.23 (-0.30; -0.15)	Ceruloplasmin	cell
F1MXX6	26	0.02	-0.22 (-0.35; -0.08)	Lactadherin	cell
Q08DQ0	6	0.017	-0.21 (-0.34; -0.08)	Plakophilin-3	cell
P07589	6	0.004	-0.20 (-0.30; -0.11)	Fibronectin	immunity
A6QNL0	6	0.01	-0.20 (-0.32; -0.09)	Monocyte differentiation antigen CD 14	immunity
P10152	11	0.048	-0.20 (-0.37; -0.04)	Angiogenin-1 (ribonuclease 5)	cell
F1MMD7	5	0.031	-0.20 (-0.34; -0.06)	Inter-alpha-trypsin inhibitor heavy chain H4	Protease inhibitor
Q3MHN2	6	0.043	-0.20 (-0.35; -0.04)	Complement component C9	immunity
P00735	7	0.028	-0.18 (-0.30; -0.05)	Prothrombin	immunity
F1MCF8	9	0.001	-0.17 (-0.22; -0.12)	Uncharacterized protein	immunity
P17690	9	0.005	-0.16 (-0.23; -0.09)	Beta-2-glycoprotein 1	Blood coagulation



Self evaluation of health changes in adults after RM (USA) or RM-kefir (NL) consumption

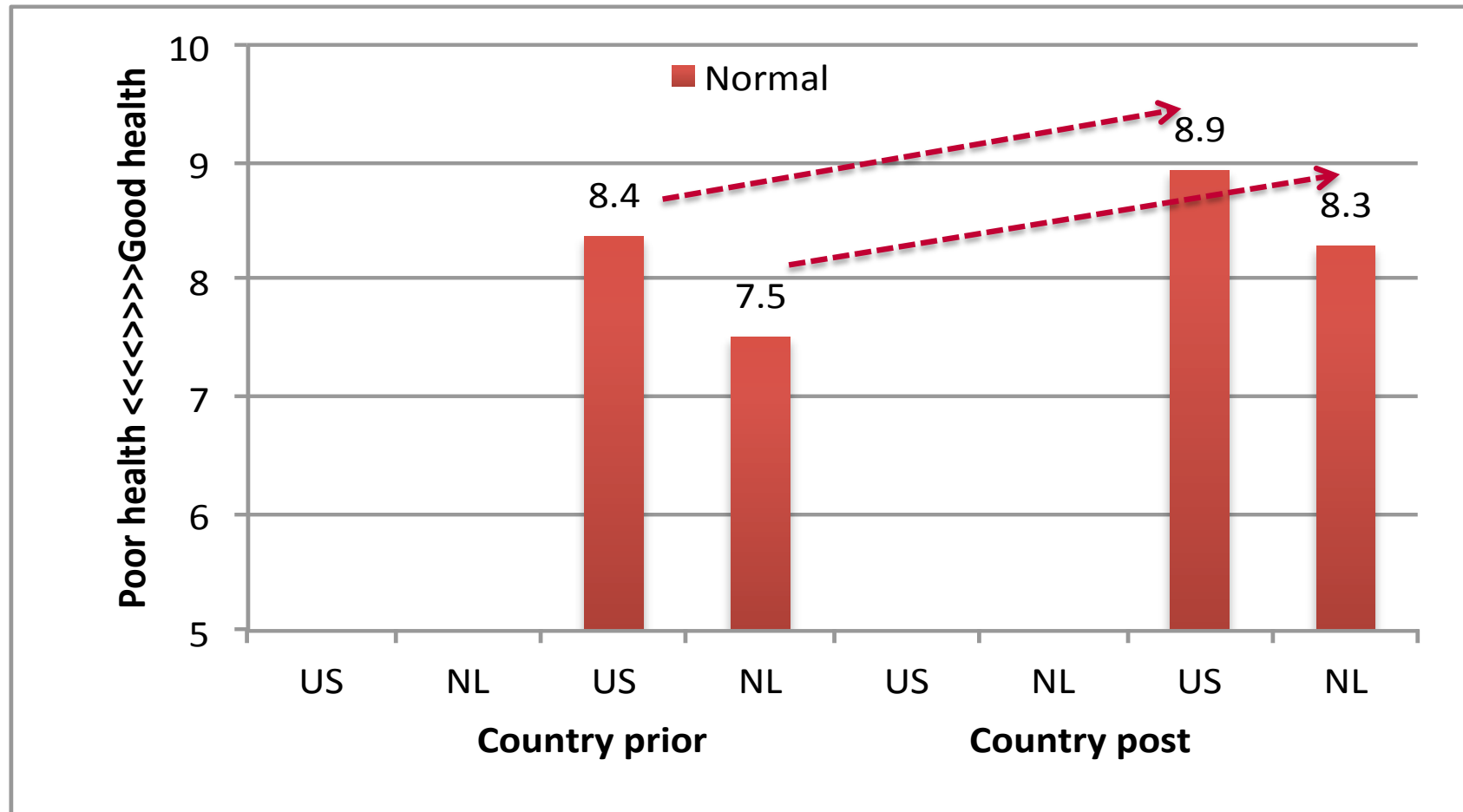


Background participants and questionnaire lay-out *(Baars et al., 2019a, b)*

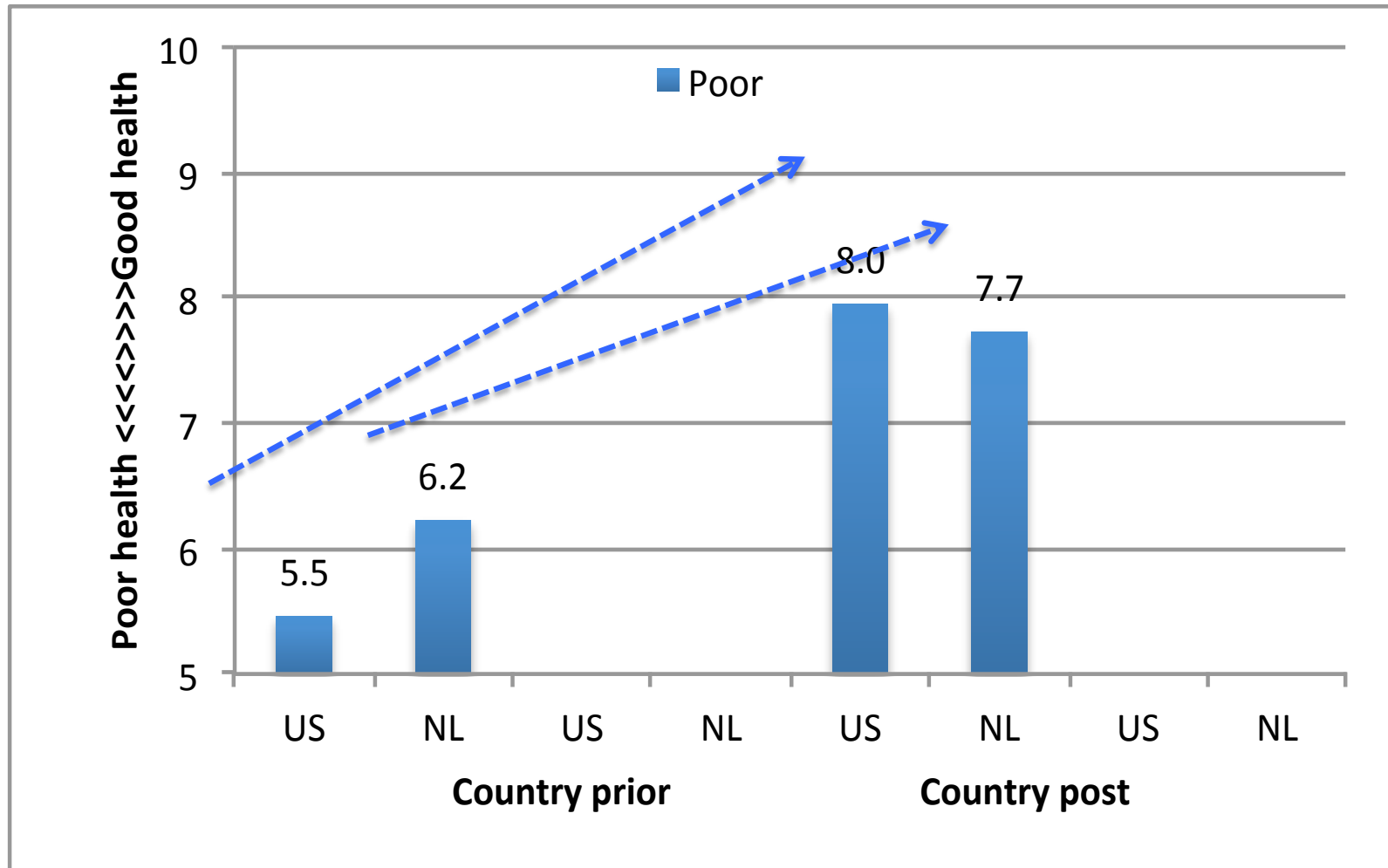
- Questionnaire among 390 NL and 330 US consumers of mainly RM-kefir and RM (Age 54 Y)
- Spring 2018
- Questions and scoring for health, immunity, bowel problems, skin problems and mood
- General part: background data and question on suffering from chronically disease and health
- Consumption milk(products) before and after conversion
- Score complaints before (1-5 or 1-10)
- Score complaints after (1-5 or 1-10)



Health score after 2 month of raw (fermented) milk consumption *(Baars et al., 2019)*



Health score after 2 month of raw (fermented) milk consumption *(Baars et al., 2019)*



Final conclusions

- There is a growing evidence from epidemiological, pre-clinical, clinical as well as immune-related explanations, that raw milk is different from heat treated milk.
- Raw milk protects in the induction of allergies, which is lost if milk was heated. Which part of the milk matrix is responsible needs further investigation, but the whey fraction is involved.
- Adult people, especially those with a poor health status experienced the strongest impact in several parts of their health and mood, after regular consumption of raw and raw fermented drinking milk.



Future perspective

- Microbiome of raw fermented kefir
- Animal studies on raw milk origin > immunity, -omics
- Animal studies on raw milk kefir > immunity, -omics
- Human studies?



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