



ULTRAFILTRATION ENHANCES THE PASSIVE IMMUNITY PROPERTIES OF LOW QUALITY COLOSTRUM

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PASSIVE IMMUNITY AND FAILURE IN PASSIVE TRANSFER (FTP)

Colostrum contributes to

- Passive immunization
- Immune maturation
- Intestinal development
- Nutrient supply

Consequences of FTP

↑
Morbidity
Mortality
Antimicrobial use
Culling rate

↓
Welfare
Health and gut health
Intestinal development
Average daily gain
Milk yield



Protection against external pathogens



Incidences of failure in passive transfer (Worldwide)

12-43 %
of the newborn calves

INCIDENCES OF LOW-QUALITY COLOSTRUM

Herd variation in colostrum Brix%

- Great variation within and across herds (Brix% 8.3 - 35.1)
- Low-quality prevalence: 41 %
- Colostrum available for calf feeding
- Insufficient high-quality colostrum to supply all newborn calves

International studies support these findings

- Low-quality prevalence: 4-60 %

Compensation of low-quality

- Quickness
- Cleanliness

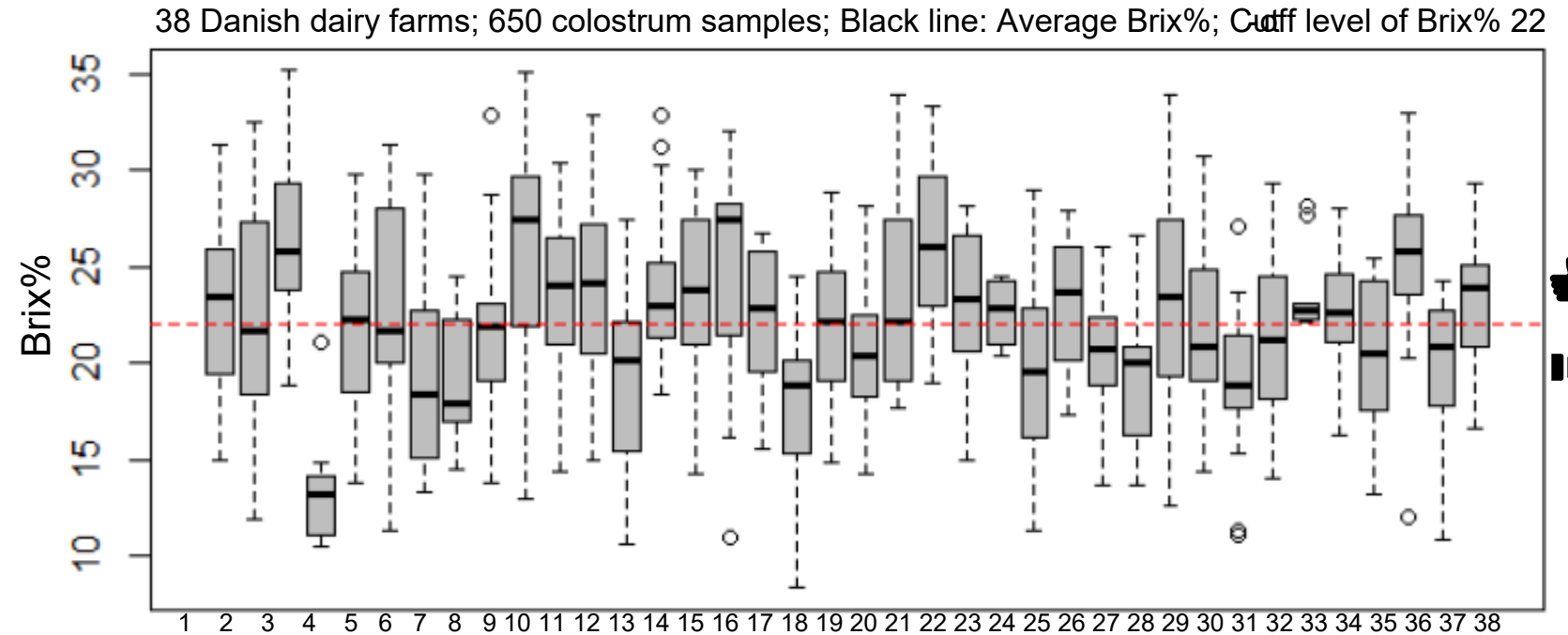
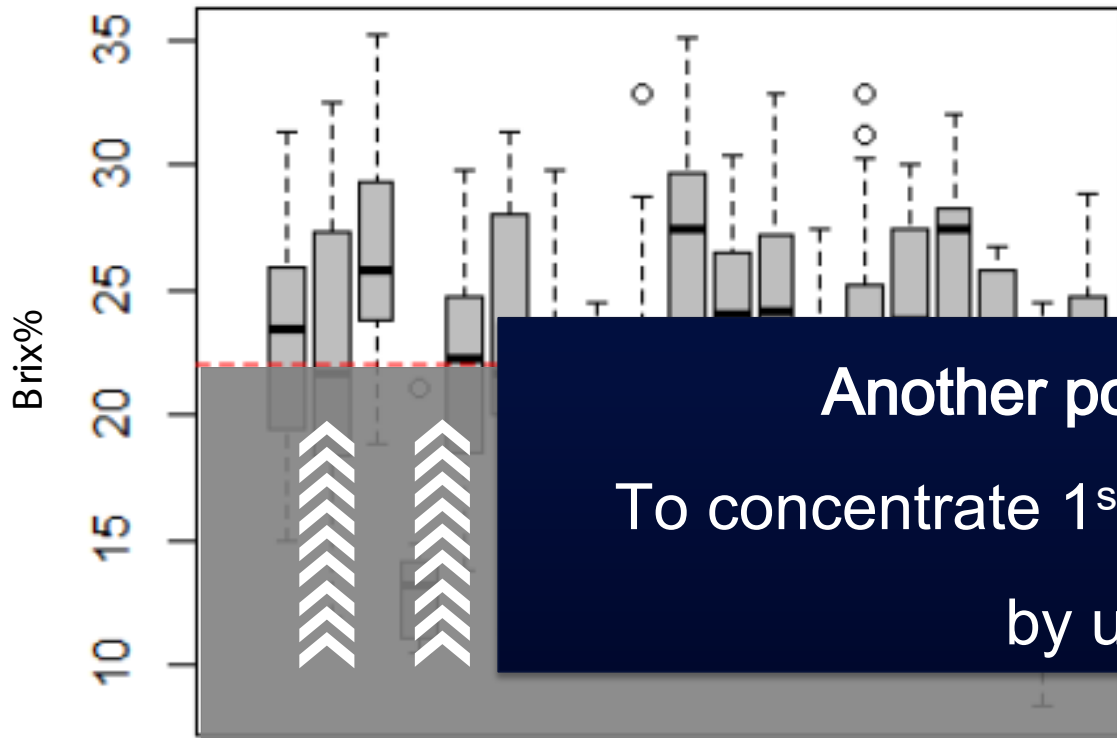


Figure directly copied from Meier (2015)

POSSIBILITIES OF IMPROVING VOLUME AND QUALITY OF COLOSTRUM



Supplementation or complete replacement with

- Dried colostrum
- Colostrum replacers/substitutes

Advantages

Another possible opportunity:
To concentrate 1st and 2nd milked colostrum
by ultrafiltration?

low-quality colostrum

quality colostrum

ts

- Impairs IgG absorption
- Non-specific IgG
- Production requires many steps of processing (expensive)



COLOSTRUM TO MILK NUTRITIONAL AND BIOACTIVE PROPERTIES

Selected colostrum constituents	Milking number			Mature milk
	1	2	3	>14 d
DM (g/kg)	24-28	18-19	14-16	12.2-12.9
Protein (g/kg DM)	13-16	8.4-8.5	5.1-6.2	3.1-3.2
Fat (g/kg DM)	6.0-7.0	5.4-5.6	3.9-4.5	3.6-4.0
Lactose (g/kg DM)	2.0-3.0	3.9	4.4	4.7-5.0
Urea (g/kg DM)	8.8	11.6	12.9	
IGF-I (ng/mL)	310	195	105	<2
IgG (mg/mL)	32-90	25-58	15-17	0.6-0.9
Albumin (mg/mL)	5.3-6.0	4.2	3.3	0.4-2.2
Haptoglobin (ug/mL)	69	94	20	
Lactoferrin (mg/mL)	1.5-5.0	0.9	0.5	0.02-0.75
TNF- α	5	ND	ND	< 2

Colostrum is rich and supplies the calves with

- Nutrients
- Growth factors
- Antibodies
- Acute phase proteins
- Cytokines

Distribution of total IgG mass produced

Colostrum: 25.1%

Early transition milk: 48.9%

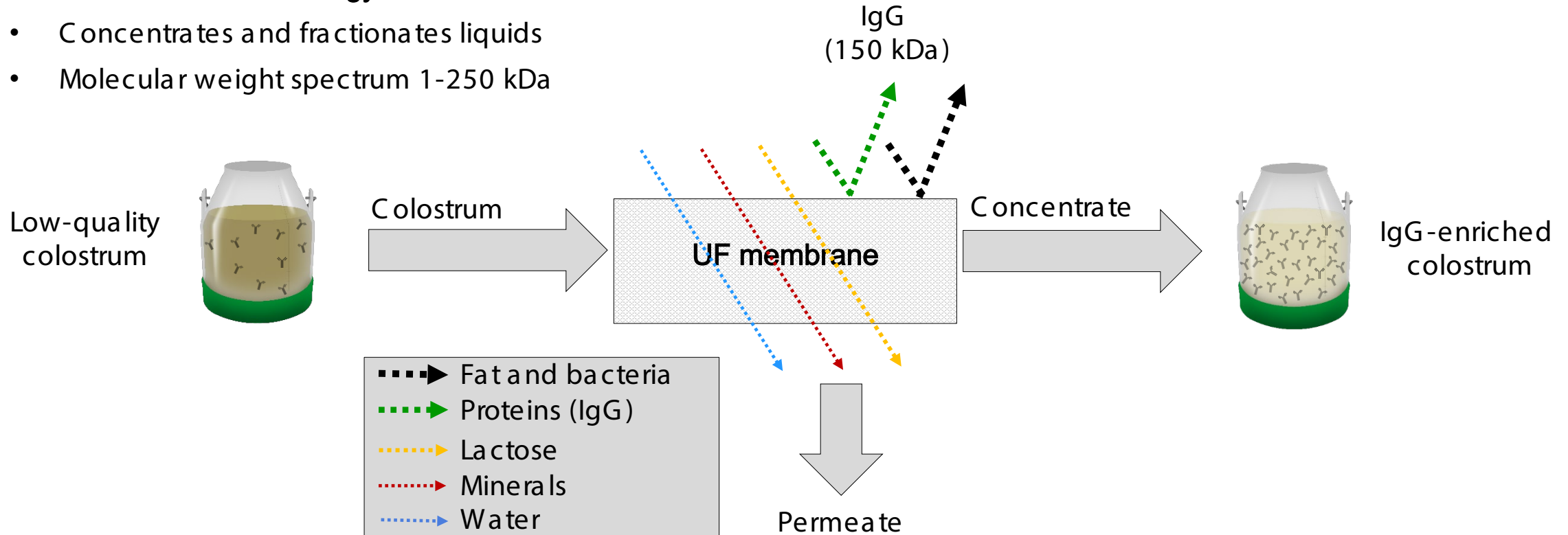
Potential

To harvest more IgG

OPTIONS FOR THE USE OF ULTRAFILTRATION (UF) OF COLOSTRUM

The ultrafiltration technology

- Concentrates and fractionates liquids
- Molecular weight spectrum 1-250 kDa

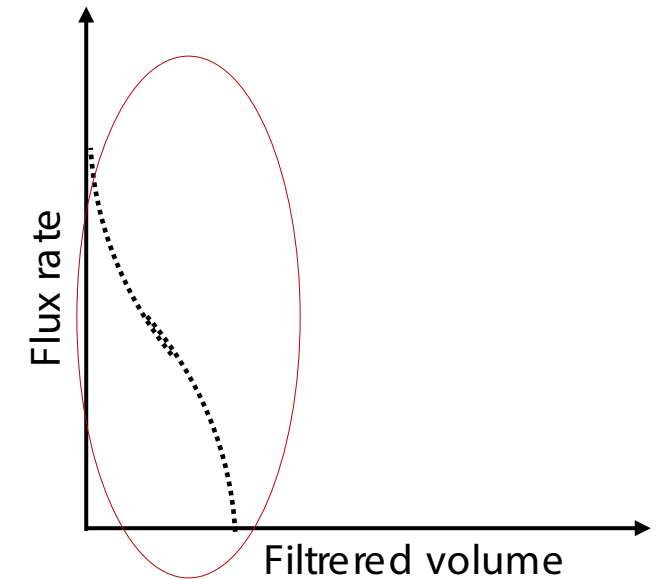
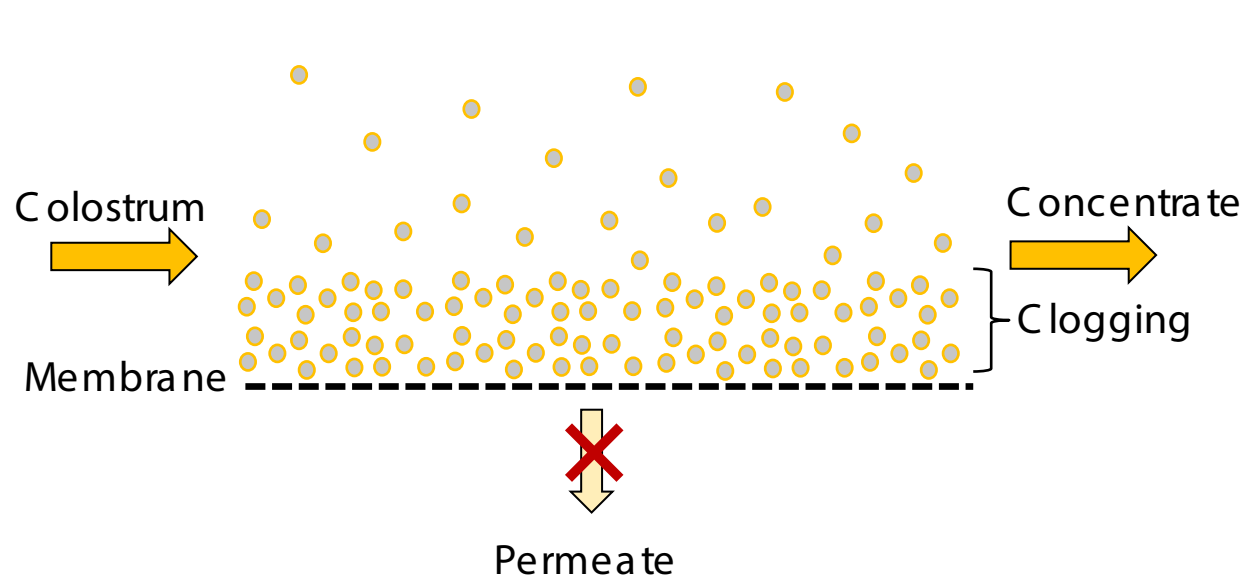


Significant disadvantage

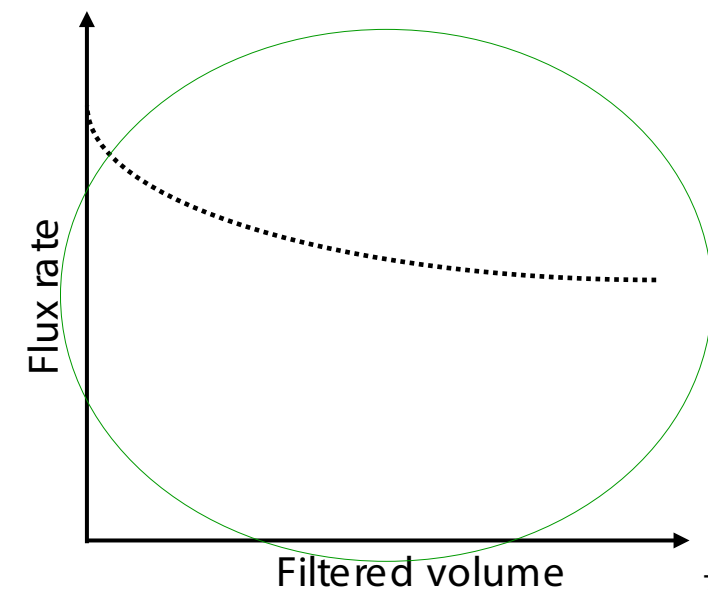
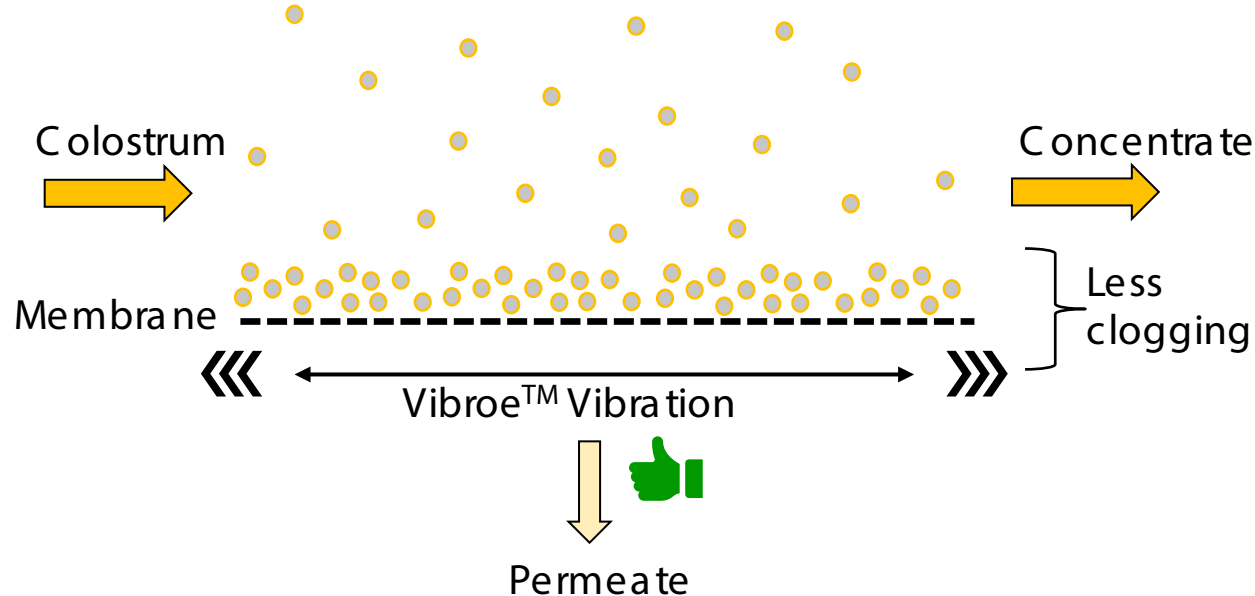
High viscosity of colostrum → High risk of fouling

THE VIBRATION TECHNOLOGY REDUCING THE RISK OF FOULING

Regular
ultrafiltration



Ultrafiltration with
vibration technology



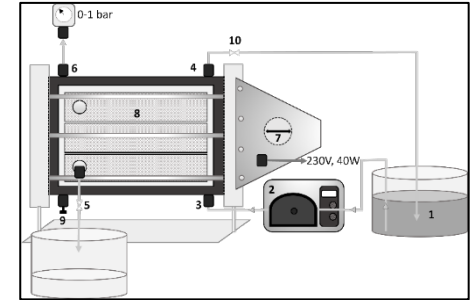
THE EXPERIMENT

Objective

To evaluate the effect of **ultrafiltration** on the **composition of colostrum and first milked transition milk** to reach high quality status (50 mg/mL of IgG)

Hypothesis

Colostrum and first milked transition milk **ultrafiltrated** with a **30 kDa molecular weight cut-off** by using vibrations shear-enhanced technology will **increase** the concentration of **IgG, proteins and fat** and **decrease** the concentration of **lactose**



MATERIAL & METHOD

A complete randomized design with:

25 batches of colostrum

Two Treatments (T)

- Non-processed colostrum (NPC)
- Ultrafiltered colostrum (UFC)

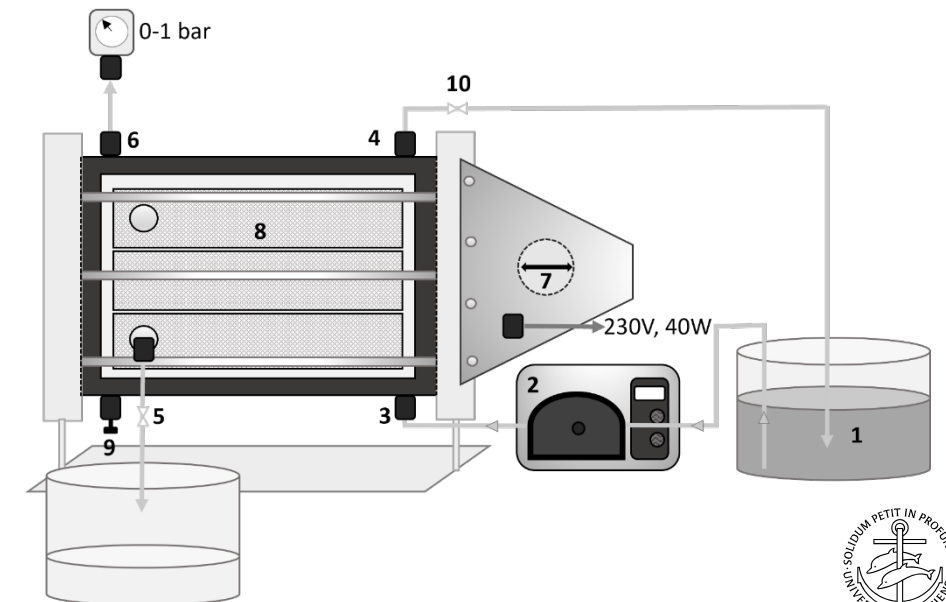
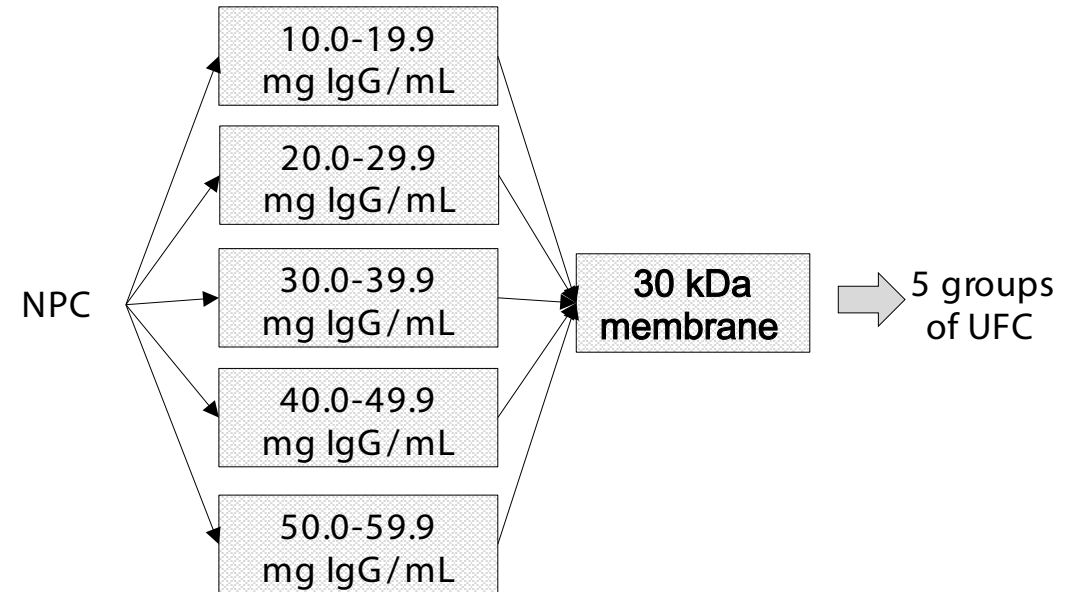
Five IgG groups, relating to initial IgG concentration
(IgG in NPC estimated by Brix% prior ultrafiltration)

Ultrafiltration equipment

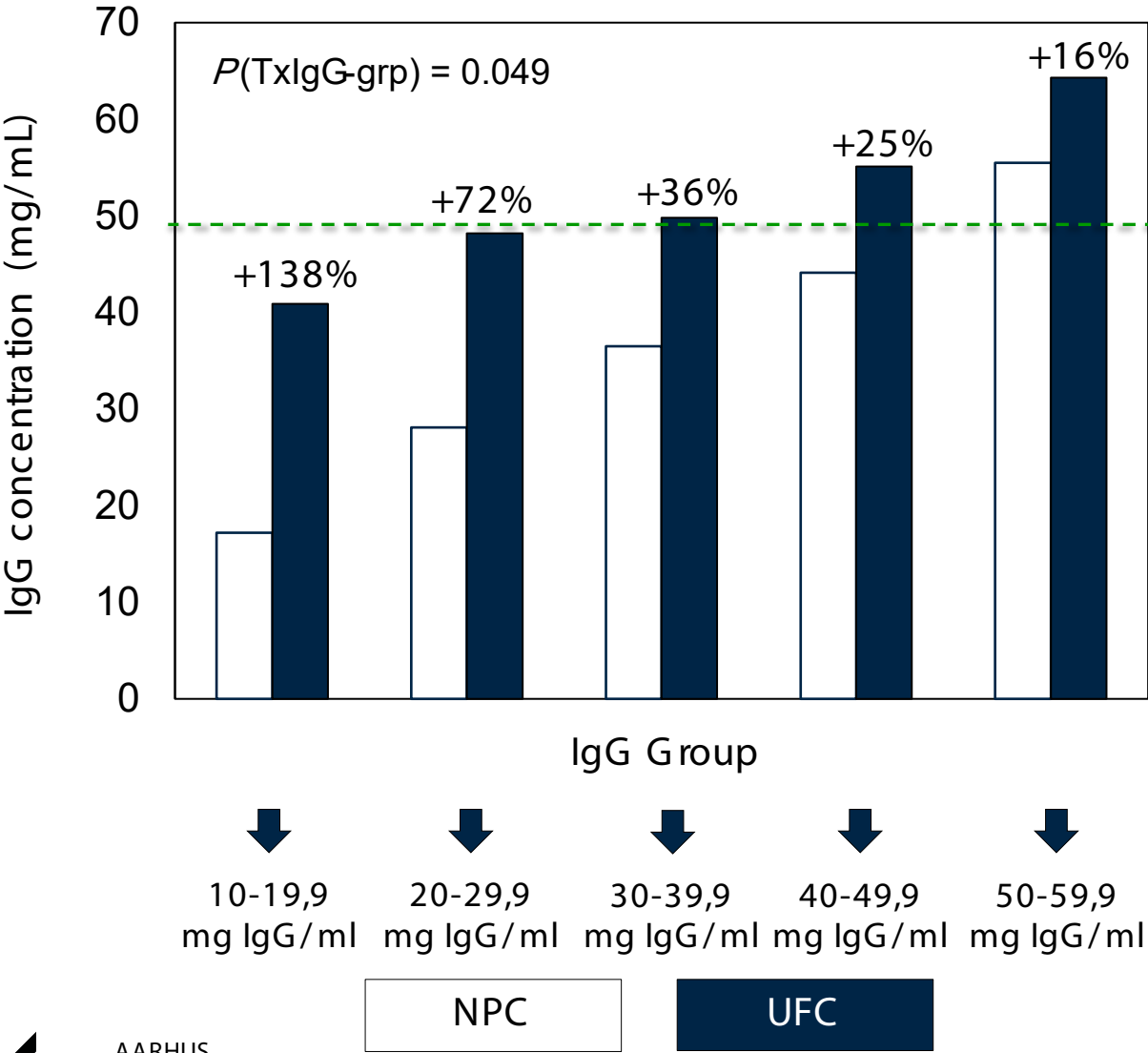
Sani Membrane Vibro™-LE system (30 kDa)

Methods

- Volumetric concentration factor (VCF), to reach 50 mg of IgG/mL (VCF from 1.4 to 3.2)
- Chemical analysis:
Elisa (IgG), Flow cytometry and FTIR (Protein, Fat and Lactose)



RESULTS



“High-quality Colostrum”

Ultrafiltration enrich colostrum in IgG

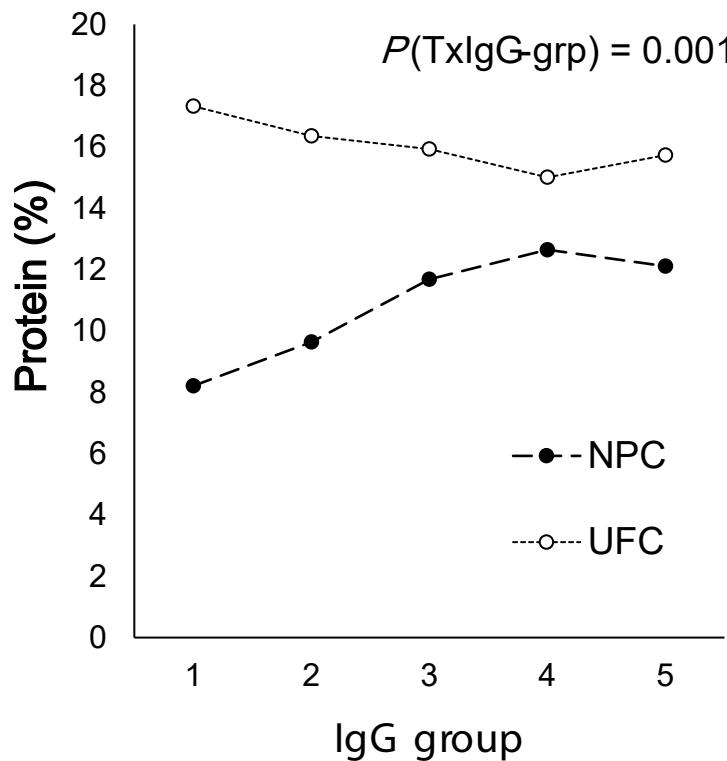
With an interaction between treatment and IgG-groups

1st and 2nd milked colostrum with IgG levels as low as 20 mg/mL can achieve “high - quality status”

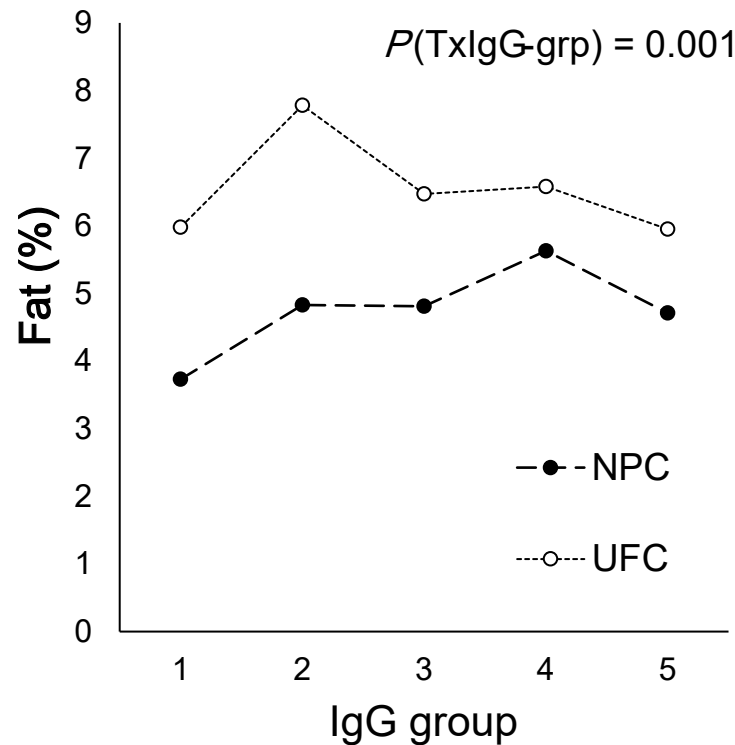


RESULTS

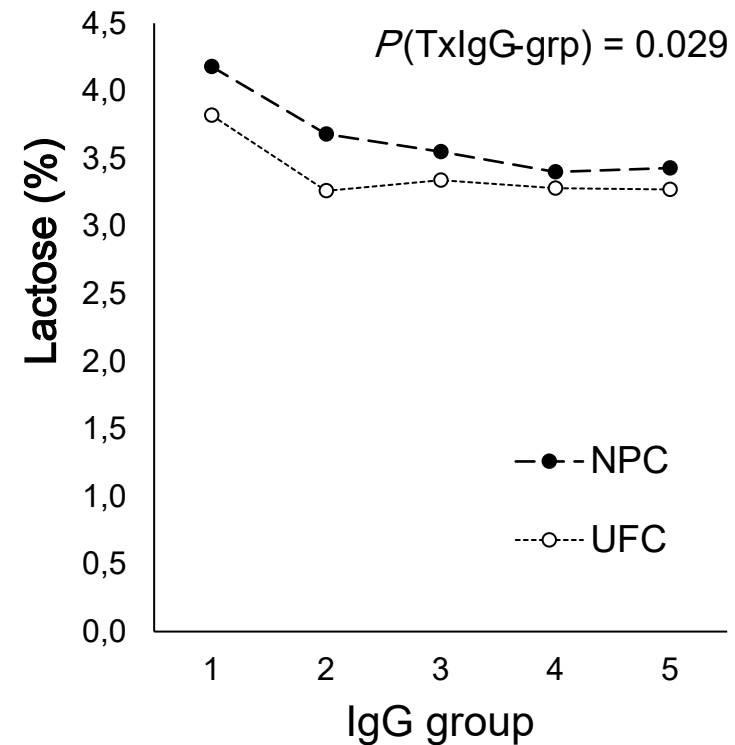
Ultrafiltration increases energy concentration in colostrum



↓ ↓ ↓ ↓ ↓
10-19,9 mg IgG/ml 20-29,9 mg IgG/ml 30-39,9 mg IgG/ml 40-49,9 mg IgG/ml 50-59,9 mg IgG/ml



↓ ↓ ↓ ↓ ↓
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↓ ↓ ↓ ↓ ↓
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CONCLUSION

- Ultra filtration **enriches** colostrum in IgG, protein, fat and decreases lactose
- The magnitude of enrichment of colostrum depends on **initial IgG** concentration
- Colostrum with **IgG > 20 mg/mL** seems most suitable for reaching high-quality status
- Total yield of high-quality colostrum can be increased by ultra filtering 1st and 2nd milked colostrum
- Ultra filtering whole colostrum, makes it directly feedable to the calves

THANK YOU FOR YOUR ATTENTION

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- *My Steering Committee*

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