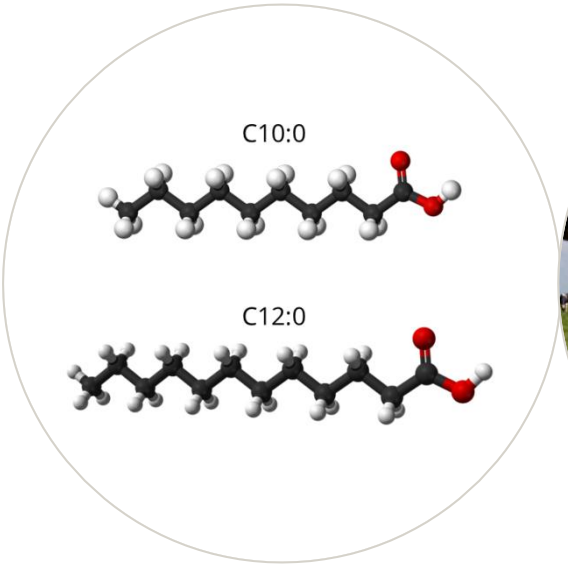
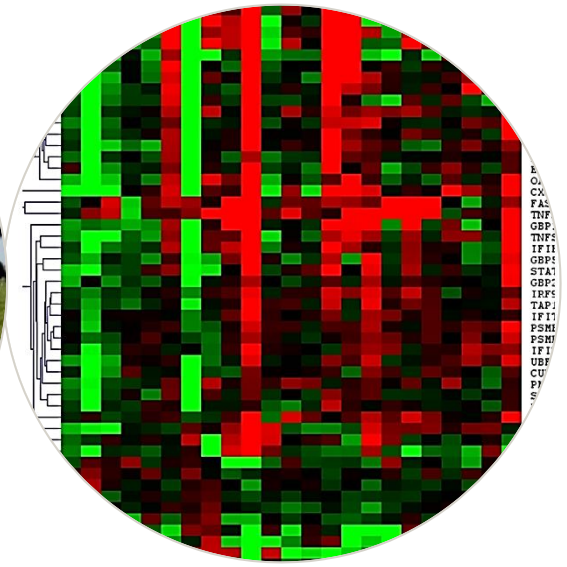
Medium-chain saturated fatty acids from dairy affect subcutaneous adipose tissue gene expression profiles

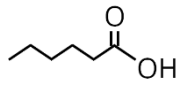
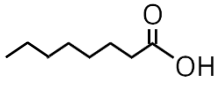
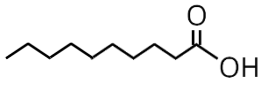
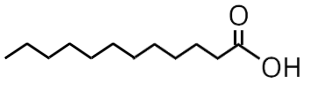
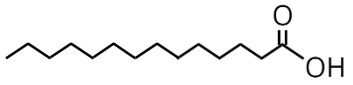
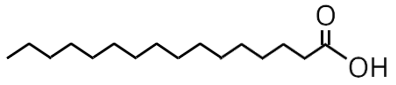
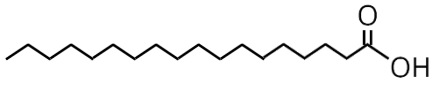
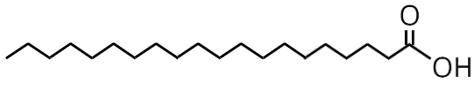
September 8, 2015

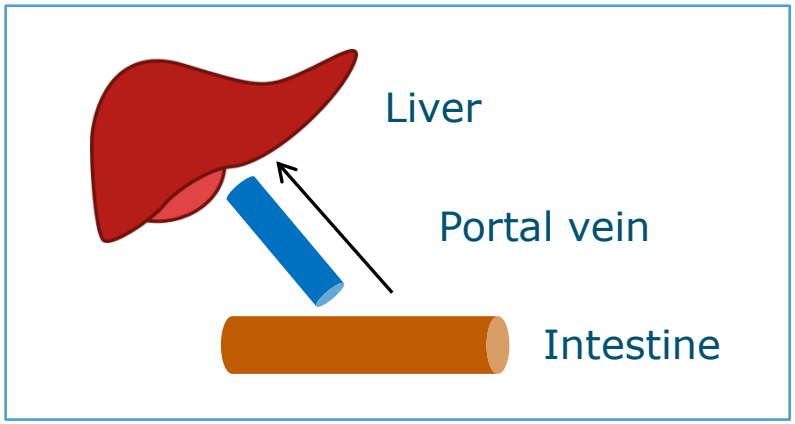
Juri Matualatupauw MSc

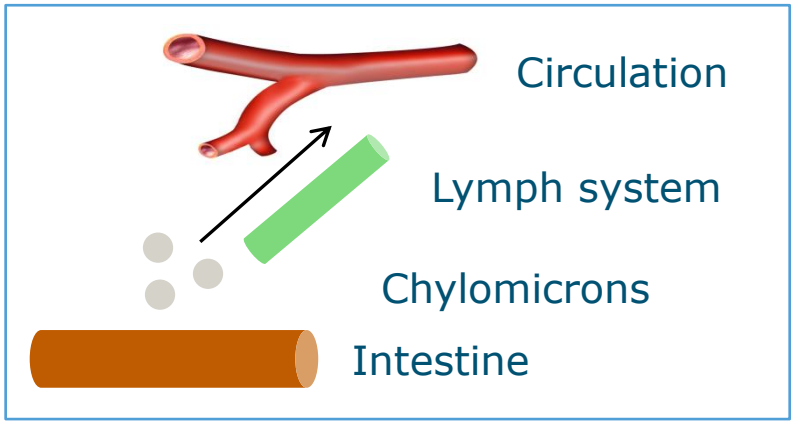




Medium-chain saturated fatty acids

Medium-chain	C6:0	
	C8:0	
	C10:0	
	C12:0	
Long-chain	C14:0	
	C16:0	
	C18:0	
	C20:0	



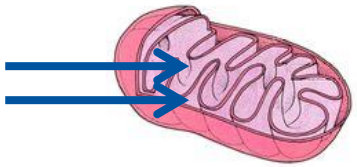


Medium-chain saturated fatty acids

- Benecifial effects on body weight and body fat percentage[1,2]

- Diffuse through mitochondrial membrane

➔ Rapid beta-oxidation[3]



- Postprandial increase in energy expenditure[4,5]

1 J Am Coll Nutr. 2015;34(2):175-83. Bueno et al.
2 J Acad Nutr Diet. 2015 Feb;115(2):249-63. Mumme and Stonehouse.
3 Int Dairy J. 2006; 16(11):1374-1382. Marten et al.
4 J Nutr. 2002 Mar;132(3):329-32. St Onge and Jones.
5 Obes Res. 2003 Mar;11(3):395-402. St Onge et al.

Small fraction of MC-SFAs reach the adipose tissue

- Small fraction of MC-SFAs reach the periphery[1]
- MC-SFA is incorporated into adipose tissue triglycerides[2]
- Changes in fat accumulation as well as adipogenic gene expression in adipocytes *in vitro* and *in vivo* in rats[2,3]

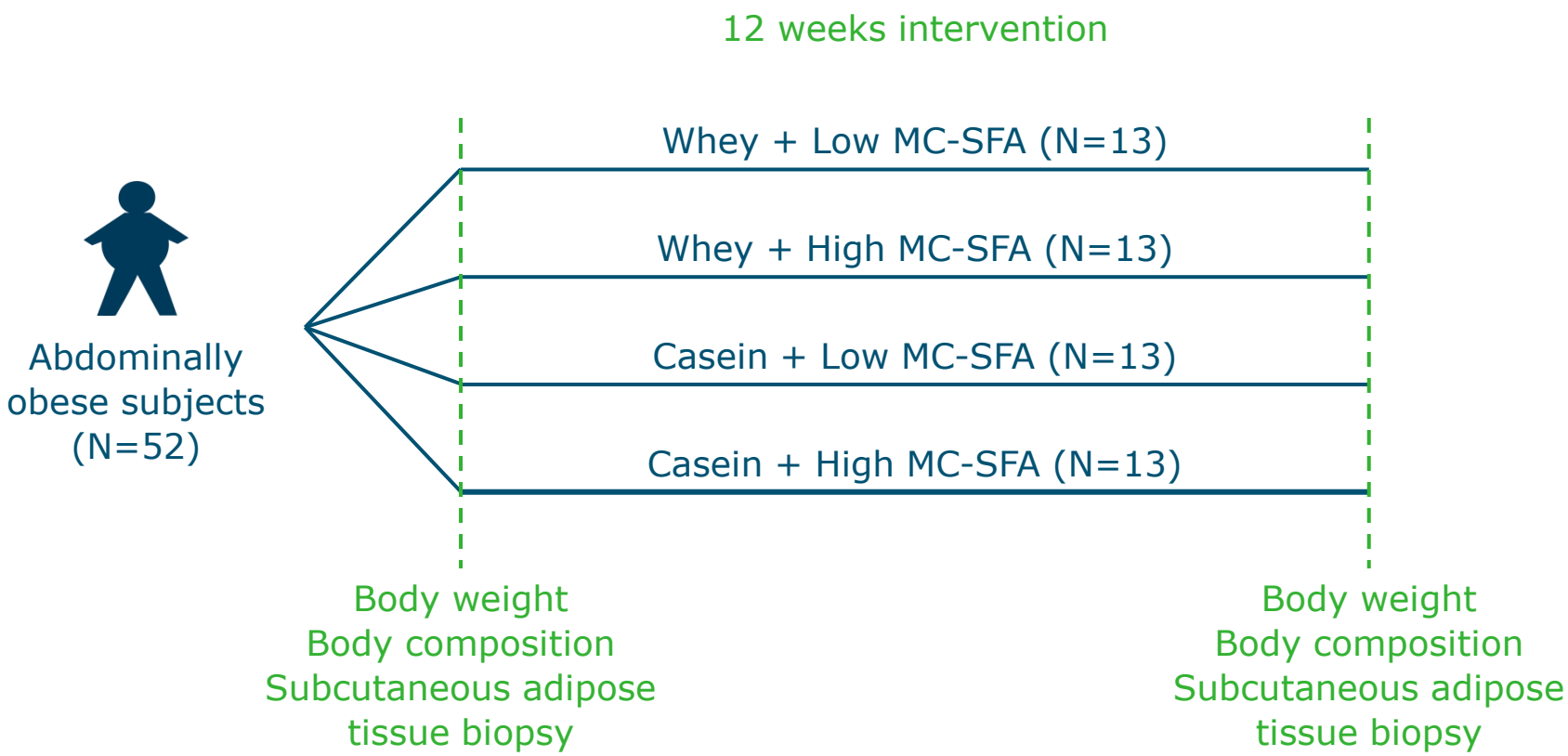
WAGENINGEN UR
For quality of life

1 Am J Clin Nutr. 1982 Nov;36(5):950-62. Bach and Babayan.
2 Obes Res. 2003 Jun;11(6):734-44. Han et al.
3 J Nutr. 2003 Aug;133(8):2512-8. Guo et al.

Objective

To explore the effects of MC-SFAs on adipose tissue distribution and gene expression pathways in humans

Study design: DairyHealth



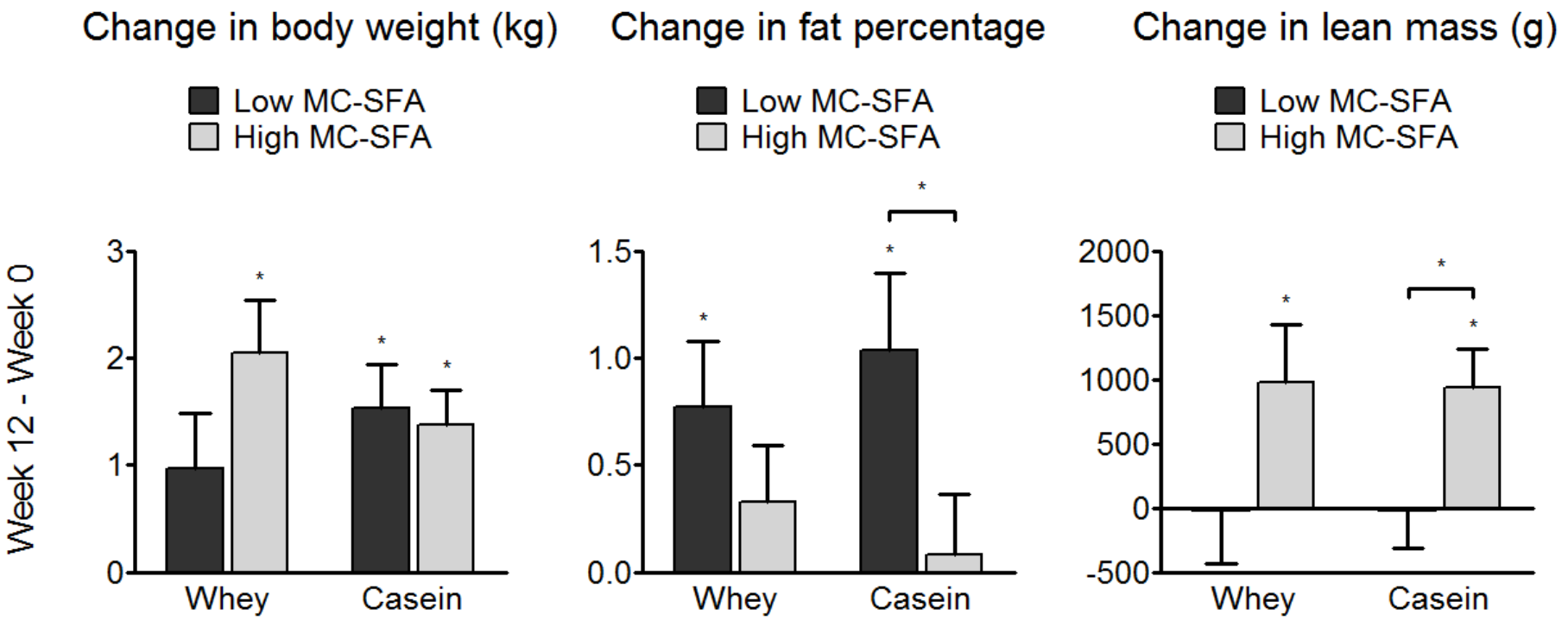
Daily diet:
60g protein (shake)
63g milk fat (2 rolls, 1 cake, 25 g butter)
1500 kcal

Baseline characteristics

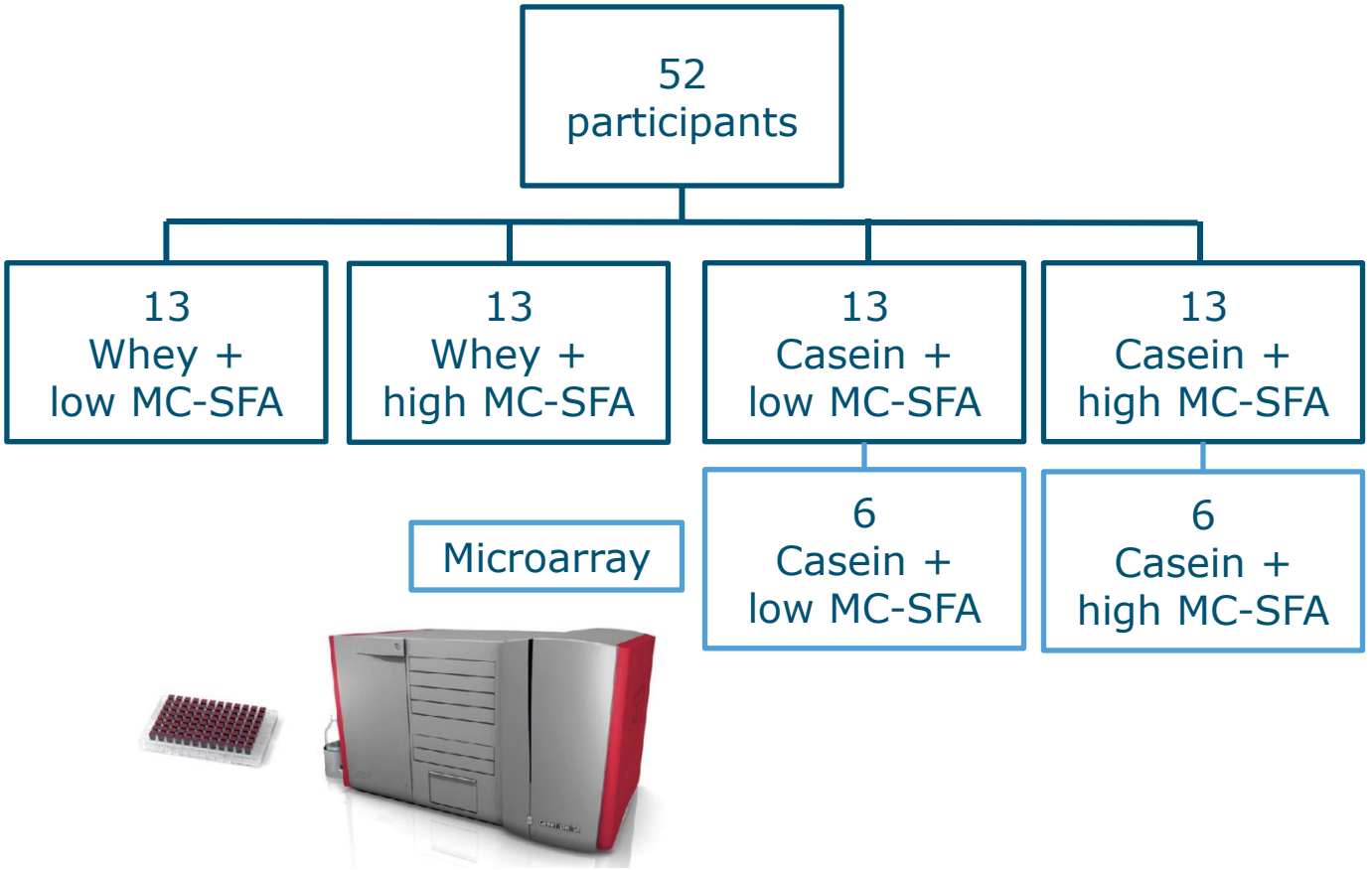
	Whey + Low MC-SFA	Whey + High MC-SFA	Casein + Low MC-SFA	Casein + High MC-SFA
N	13	13	13	13
M/F	5/8	6/7	6/7	7/6
Age (years)	61.1 (55.1-67.0)	50.0 (40.6-59.4)	56.7 (46.1-67.3)	59.0 (50.7-67.3)
BMI (kg/m²)	28.6 (26.6-30.7)	29.5 (27.4-31.5)	28.2 (25.8-30.6)	28.9 (26.4-31.4)
Waist circumference (cm)	104 (96-112)	103 (96-109)	101 (94-109)	106 (99-112)

All values: Mean (95% CI)

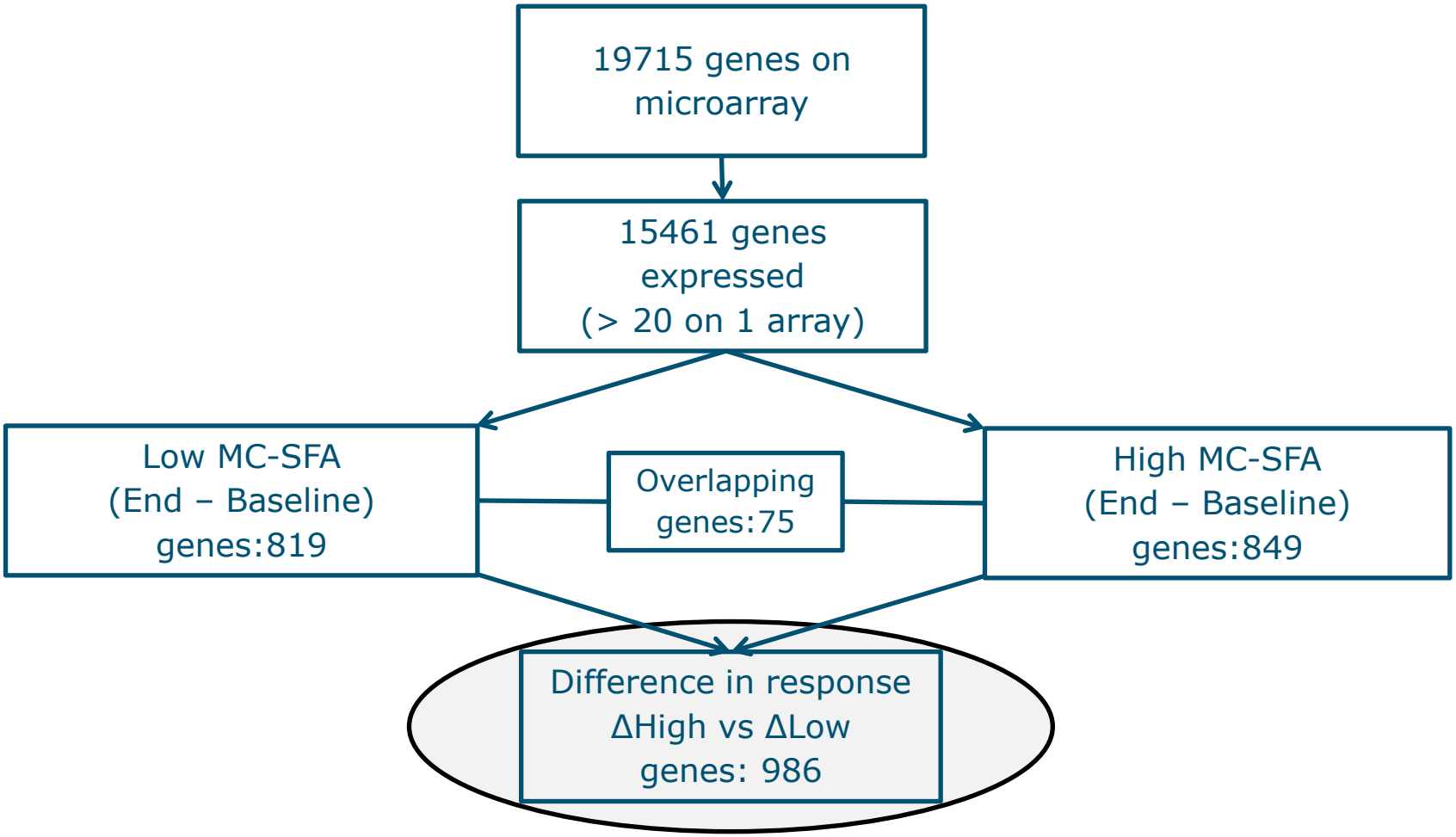
Changes in body composition



Microarray study design

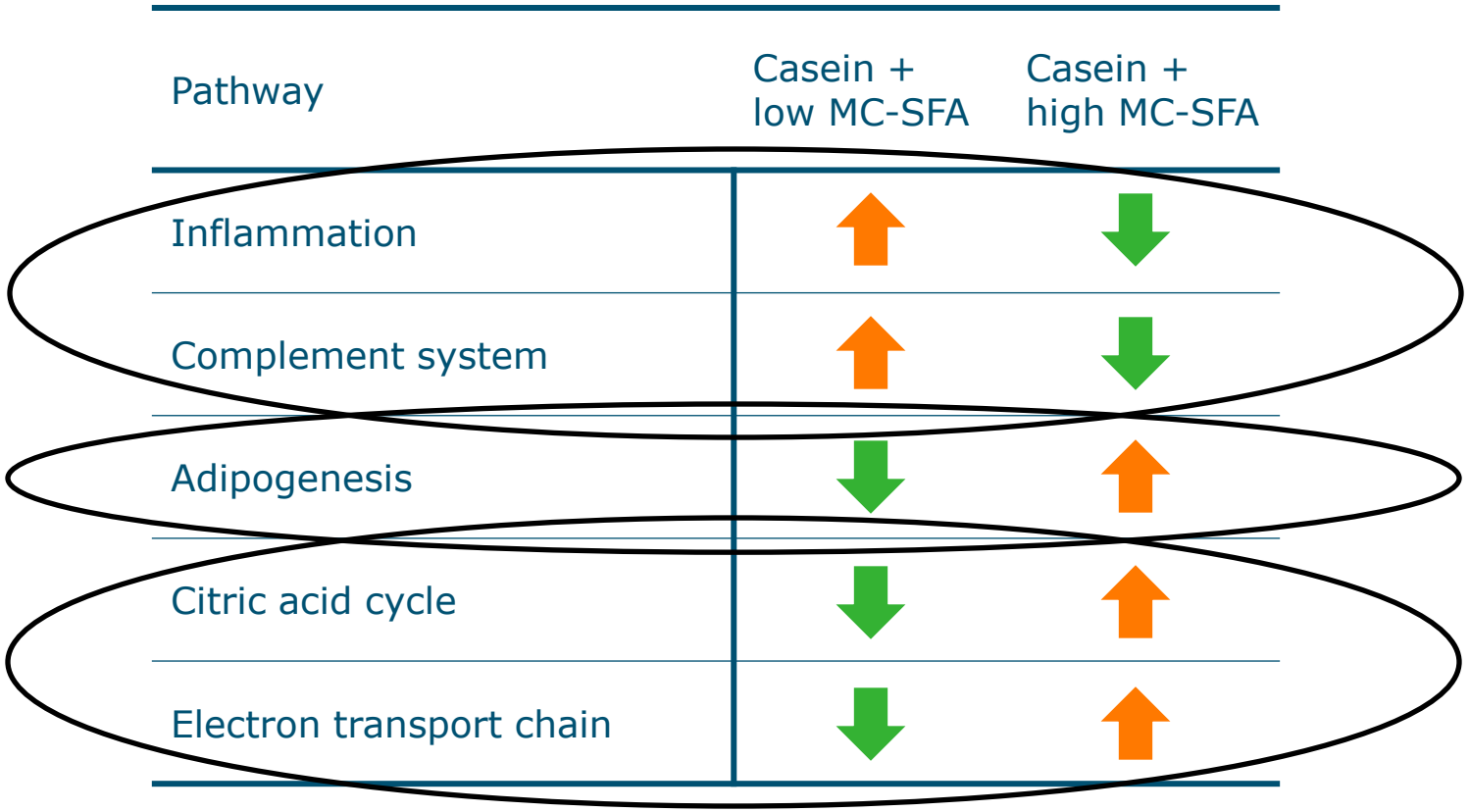


Differentially expressed genes



Pathway analysis

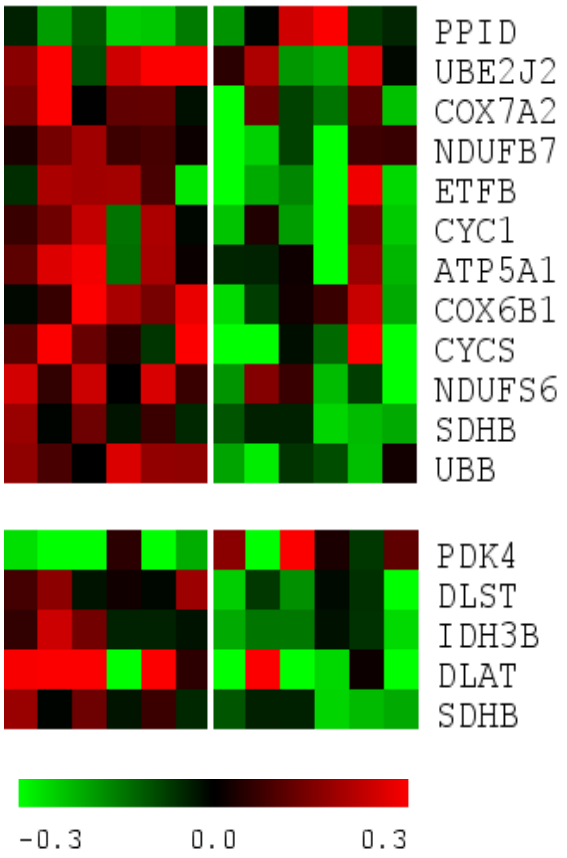
From gene set enrichment analysis:

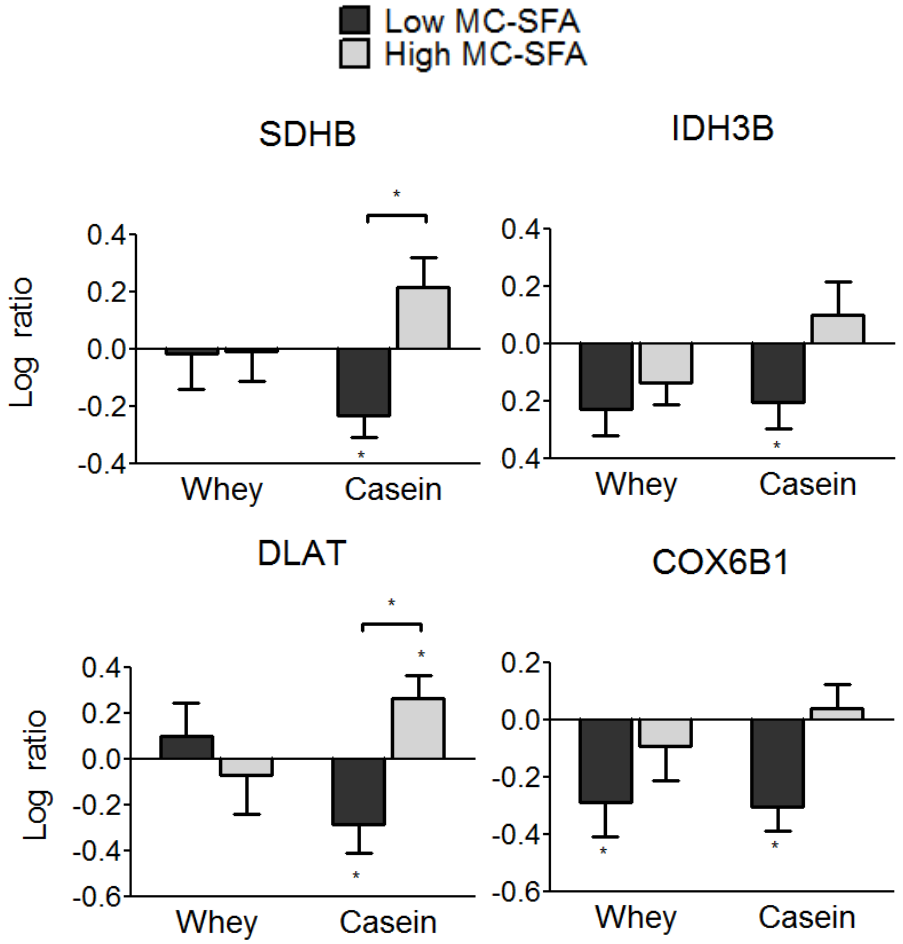


Citric acid cycle and electron transport chain

Citric acid cycle

Electron transport chain

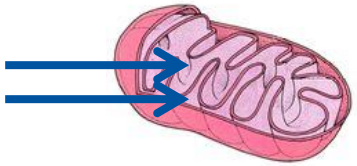




Discussion: citrate cycle & electron transport chain

- MC-SFA diffuse through mitochondrial membrane

➔ Rapid beta-oxidation[1]

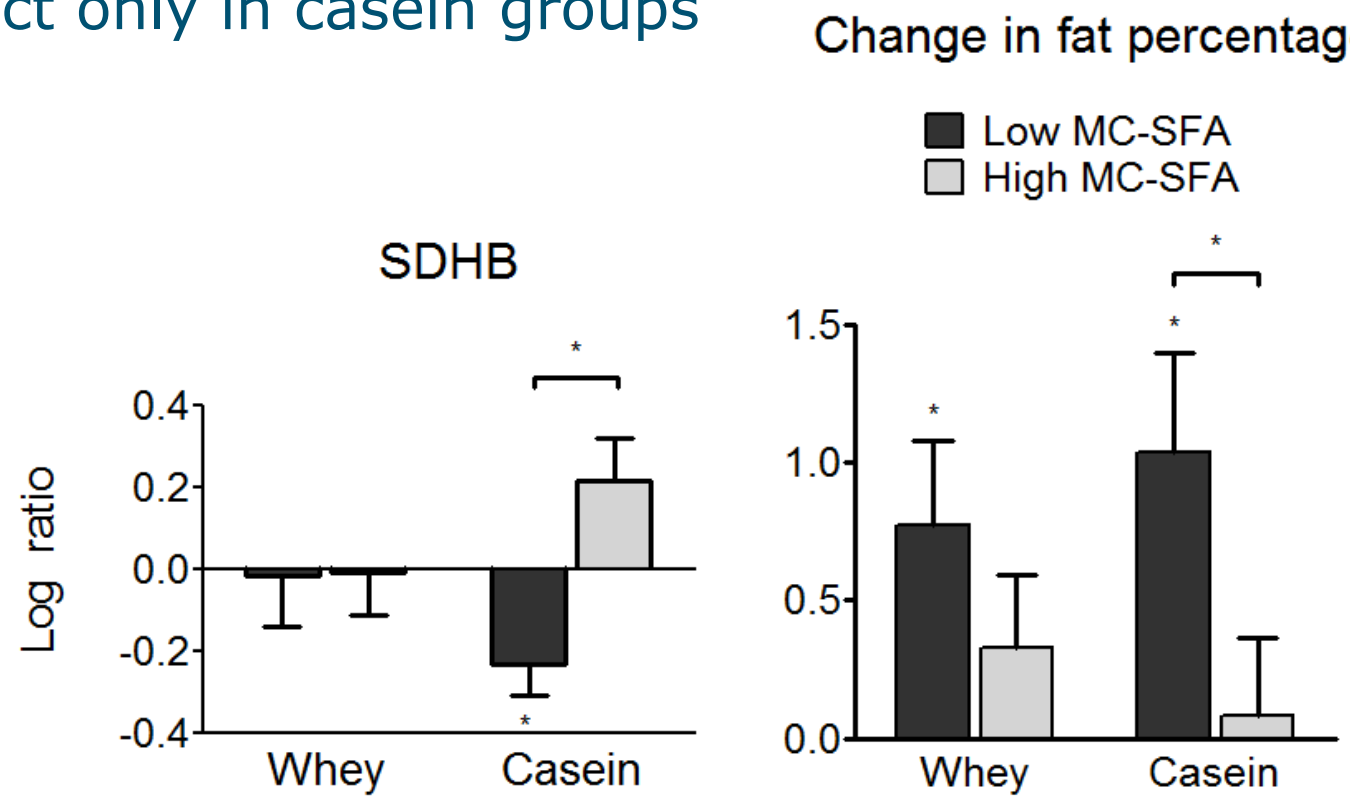


Upregulation of pathways may be related to increased energy expenditure[2,3]

1 Int Dairy J. 2006; 16(11):1374-1382. Marten et al.
2 J Nutr. 2002 Mar;132(3):329-32. St Onge and Jones.
3 Obes Res. 2003 Mar;11(3):395-402. St Onge et al.

Discussion

- Effect only in casein groups



Conclusion

MC-SFAs seem to have a protective effect against increased body fat percentage

In adipose tissue, consumption of MC-SFA increased expression of genes related to citric acid cycle and electron transport chain, potentially increasing energy metabolism

Acknowledgements

Mette Bohl

Ann Bjørnshave

Mette K. Larsen

Søren Gregersen

Kjeld Hermansen

Mechteld Grootte-Bromhaar

Lydia Afman