Milk copper concentration
– causes of variation and effect on milk flavour

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SUMMARY

Spontaneous oxidized flavour (SOF) in cow's milk is a relatively common quality defect that causes significant economic losses to producers and the dairy industry.

- **SOF in milk was mainly associated with high milk copper conc., probably acting as prooxidant**
- **High milk copper conc. was in turn mainly found during early stage of lactation**

DEVELOPMENT OF SOF

Spontaneous oxidized flavour (SOF)

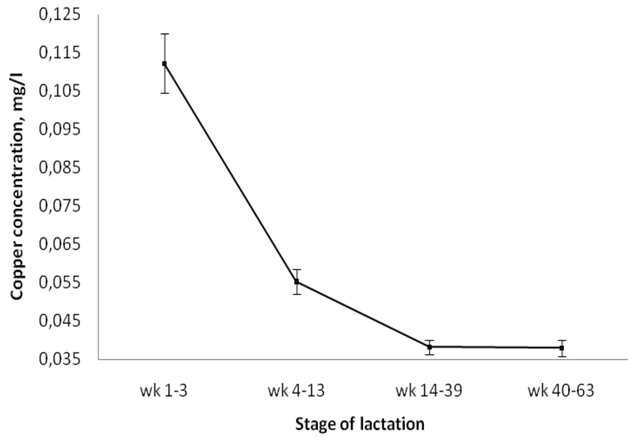
Substrate: Unsaturated fatty acids act as substrate

Prooxidants: Transition metal ions like copper propagate fat oxidation

Auto-oxidation of unsaturated milk fatty acids

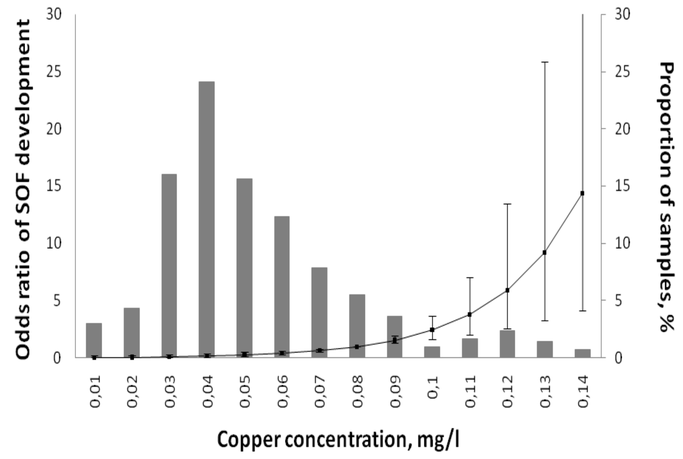
RESULTS

Copper concentration



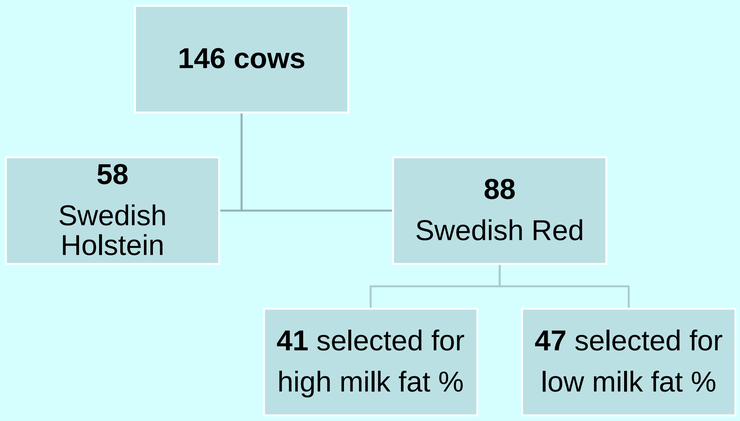
Trait	df	F-value	P-value
Stage of lactation	3	90,66	<,0001
Fat, %	1	20,81	<,0001
Season x year	9	3,39	0,0004
Housing x group	5	1,91	0,0603

SOF



Trait	df	F-value	P-value
Copper, mg/l	1	18.01	<.0001
Stage of lactation	3	3.31	0.0200
Season x year	9	1.82	0.0612
Housing x group	5	1.95	0.0926

MILK RECORDS



Altogether 933 monthly milk samples were analysed for fat, protein, lactose, and copper concentration. A taste panel graded each sample as having no, moderate or pronounced off-flavour (SOF).

STATISTICAL ANALYSIS

❑ Copper concentration

Proc Mixed:

$$y_{ijklmn} = \mu + \mathrm{sl}_i^{*} + \text{housing x group}_{jk} + \text{season x year}_{lm} + a_n + e_{ijklmn}$$

❑ Oxidative off flavour (SOF)

Proc Glimmix, analysis with a multinomial cumulative logistic model:

$$y_{ijklmnop} = \mu + \mathrm{sl}_i^{*} + \text{copper}_j + \text{housing x group}_{kl} + \text{season x year}_{mn} + a_o + e_{ijklmnop}$$

*Stage of lactation (i = 1, 2 …4)

Repeated measures on cow were modeled using the SP(POW) structure, with week of lactation as time variable. The analysis included a relationship matrix.