

# Bindevev, frie aminosyrer og mineralenes betydning for tekstur

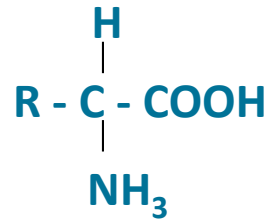
Marit Espe

Hell 17.06.09

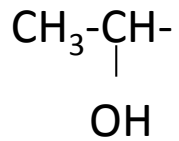
# IAA's i fiske ernæring

- Behov for 10 AA's
- Andre dyr har behov for 8 (9)
- Fisk har lav ureasyklus og har derfor et behov også for arginin

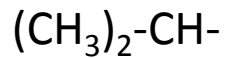
# Indispensable AAs i fisk:



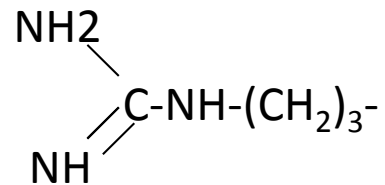
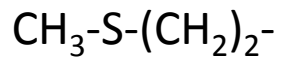
Thr



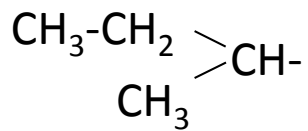
Val



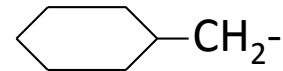
Met



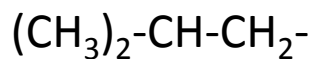
Arg



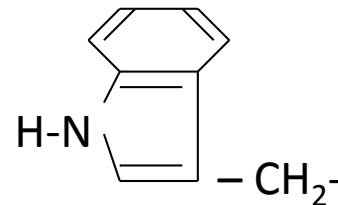
Ile



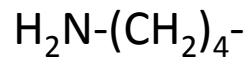
Phe



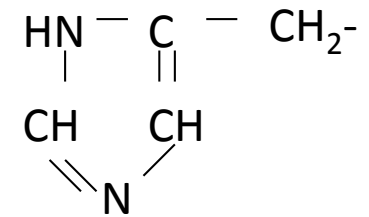
Leu



Trp



Lys



His

**Table 1.** The protein (g/16gN), total- and free amino acid content (mg/g protein) in domestic animals (beef) and fish muscle. The free amino acids constitutes minor amount.

AA's	Total AA's		Free AA's		% free of total	
	Beef <sup>1</sup>	Fish muscle <sup>1</sup>	Beef <sup>2</sup>	Fish muscle <sup>3</sup>	Beef	Fish muscle
Protein	20-23	20-22	-	-	-	-
Met*	23	30	0.15	0.10	0.65	0.44
Lys*	85	89	0.62	0.65	0.73	0.73
Thr*	40	45	0.15	0.24	0.39	0.38
Val*	59	51	0.28	0.20	0.47	0.40
Ile *	52	49	0.37	0.08	0.71	0.16
Leu*	83	80	0.80	0.24	0.96	0.30
Trp*	11	12	0.009	-	0.08	-
Phe*	41	43	0.37	0.16	0.91	0.37
His(*)	32	34	0.47	1.24	1.48	3.65
Arg*	67	63	0.90	0.12	1.34	0.19
Tyr	33	36	0.43	0.30	1.32	0.83
Gly	73	49	0.21	0.90	0.29	1.84
Ser	40	41	0.35	0.14	0.88	0.34
Pro	56	36	0.16	0.15	0.29	0.42
Ala	60	64	1.49	1.20	2.49	1.88
Asp	88	97	0.11	0.07	0.12	0.07
Glu	149	152	2.70	0.83	1.81	0.55
ΣAA's	991	971	9.57	6.62	0.96	0.68
NPN	9	29	-	-	-	-

\*Regarded essential for the human being. <sup>1</sup>Adopted from Espe, 2008; <sup>2</sup> Adopted from Koutsidis et al., 2008 (stored 10 days) <sup>3</sup> Espe, unpublished result (stored 5 days), Glu and Asp is the sum of amide and acid.

## Fôringrediensene har endret seg

	<u>AAs (g/16gN)</u>	<u>fish meal</u>	<u>poultry by-products</u>	<u>bloodmeal</u>	<u>cormgluten</u>	<u>soyprotein</u>
	IAA	43,9	38,3	54,2	44,1	44,9
	DAA	48,0	54,3	45,5	61,9	52,3
	IAA/DAA	0,91	0,71	1,19	0,71	0,83
Dyr har ikke egentlig et proteinbehov	TSAA	3,7	3,3	2,3	4,1	2,9
	TAAA	9,5	10,5	10,8	11,3	8,9
Har behov for en balansert AA-profil	<b>Non AA-N</b>	<b>8</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0,7</b>
	Lys/Arg	1,3	0,8	2,0	0,5	0,8
AA-profil ulik i ulike foringredienser	Met/Cys	2,9	1,0	1,0	1,4	1,0
	Leu/Ile	1,8	1,9	10,6	4,3	1,8
Ikke aminosyre nitrogen (non AA-N) er forskjellig i ulike ingredienser	Leu/Val	1,5	1,7	1,5	3,8	1,7
	Gly/Ser	1,6	2,0	0,9	0,5	0,8
	Lys/His	2,9	2,7	1,4	0,8	2,1
	TSAA/Lys	0,5	0,7	0,3	2,6	0,5
	TAAA/Lys	1,3	2,1	1,3	7,2	1,5

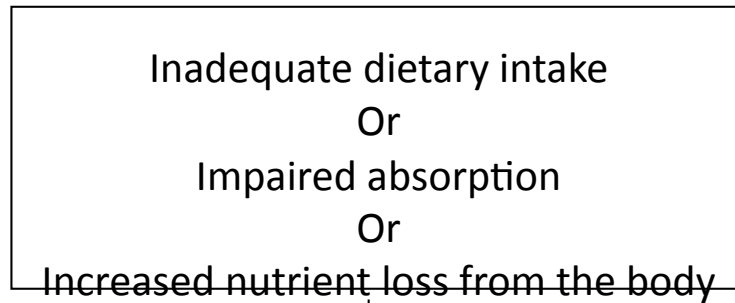
Well nourished



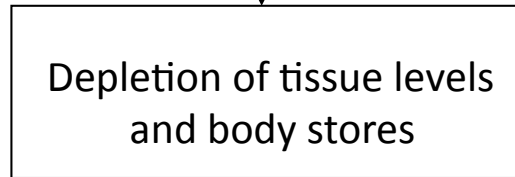
Individual at risk



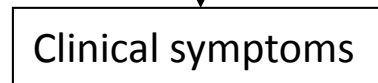
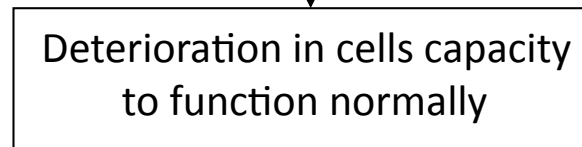
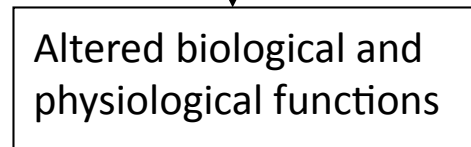
Acutely malnourished individual



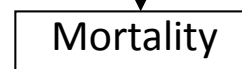
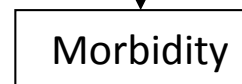
Dietary survey,  
Nutrient intake



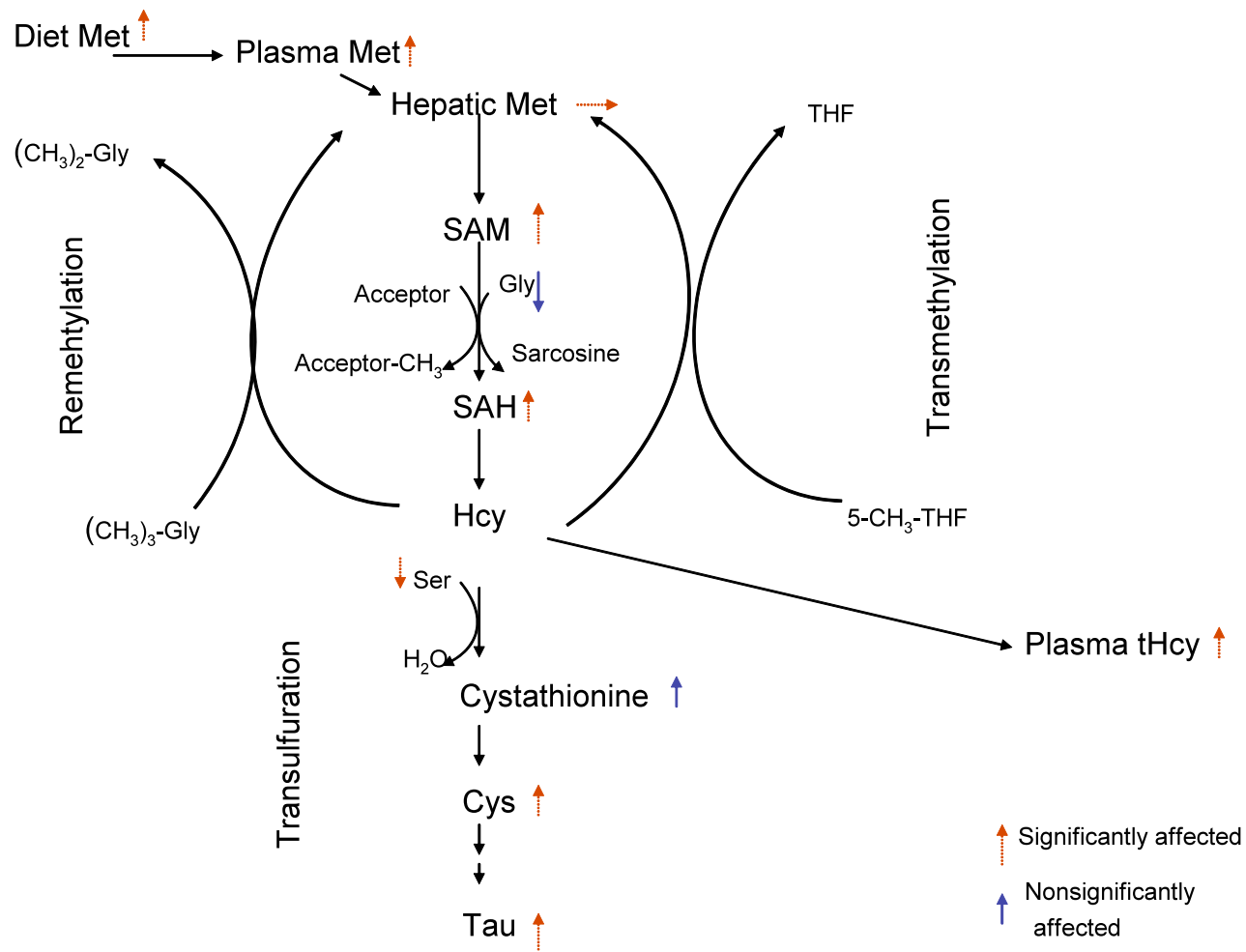
Biochemical &  
Physiological studies  
Metabolic experiments



Clinical signs and  
symptoms



Vital statistics



MCD dietter er kjent å gi fettlever,  
Met mangel gir fettlever hos laks

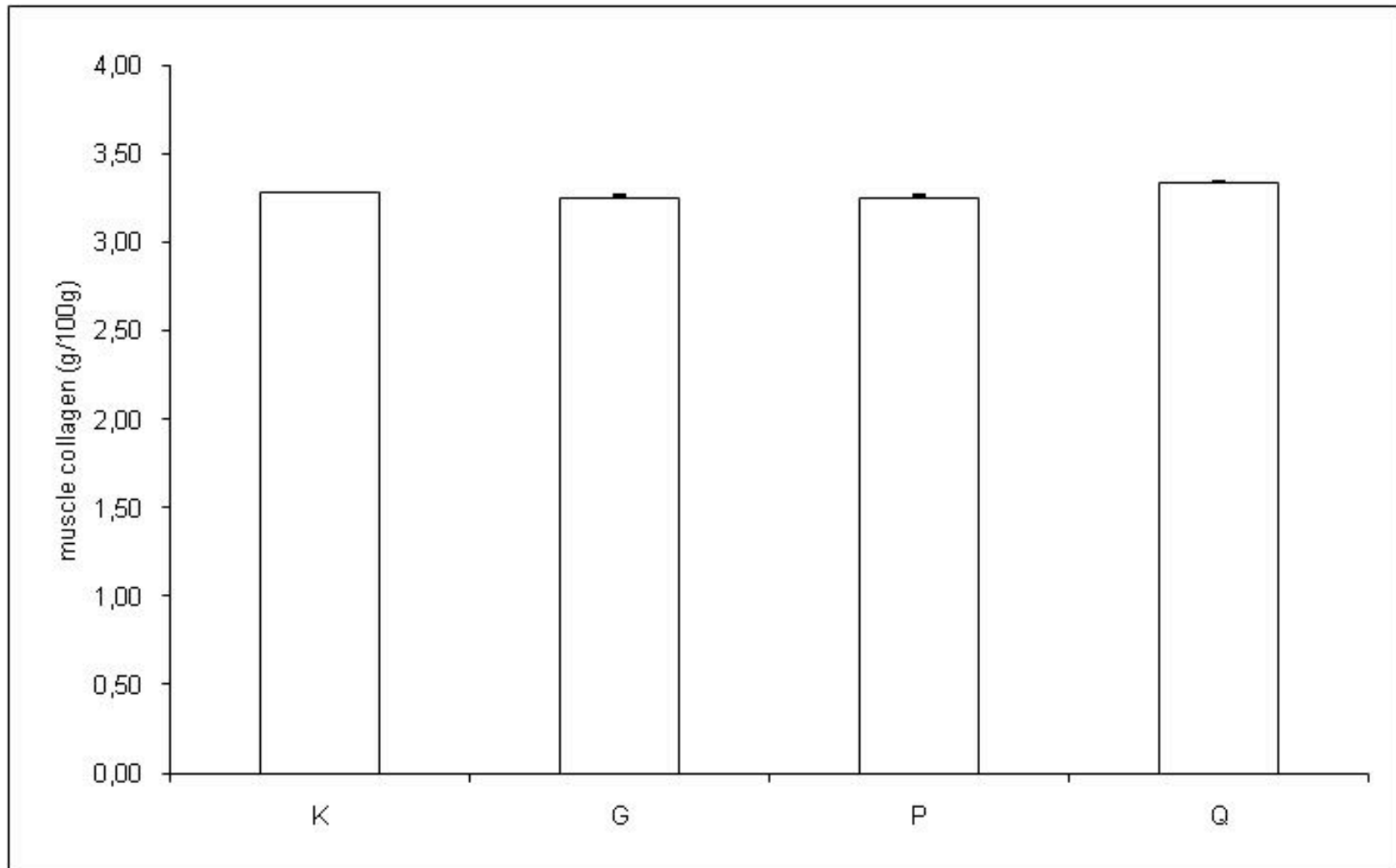
From Espe et al, 2008

# Frie aminosyrer og metabolitter,- ulike lokaliteter

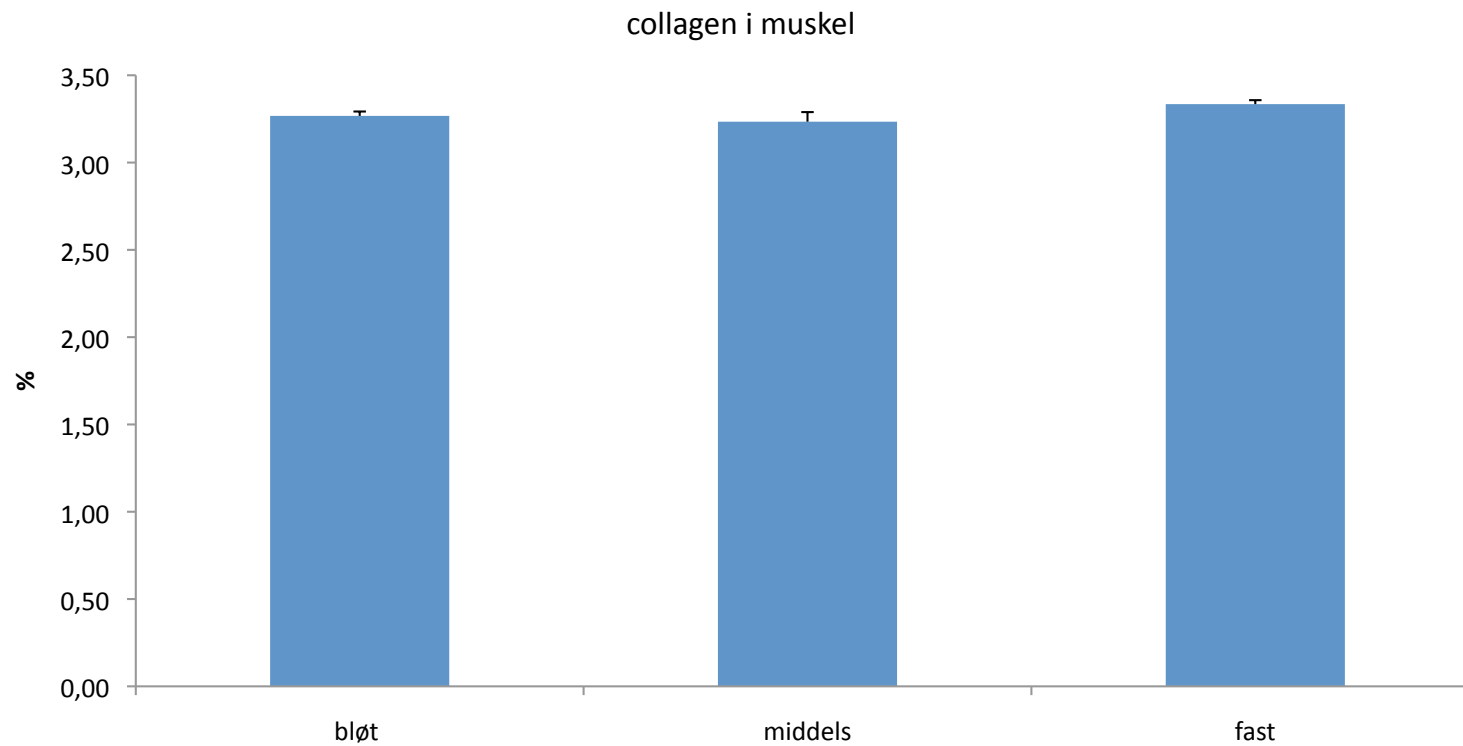
- Atlantisk laks fra fire ulike lokaliteter
  - K, Q, P & G
- Frie N metabolitter i NQC
  - Samme prøver som analysert av NOFIMA
- Total collagen
  - Differansen total og fri OH-pro, (OH-pro\*11.42; Sato et al. 1991)
- Frie N metabolitter i 3 ulike områder av fiskemuskel
  - Bare for noen av fiskene grunnet at ikke tatt ut for alle gruppene
  - Fremme i muskel i bløt stripe og over bløt stripe
- Mineraler (Cu, Zn, Se)



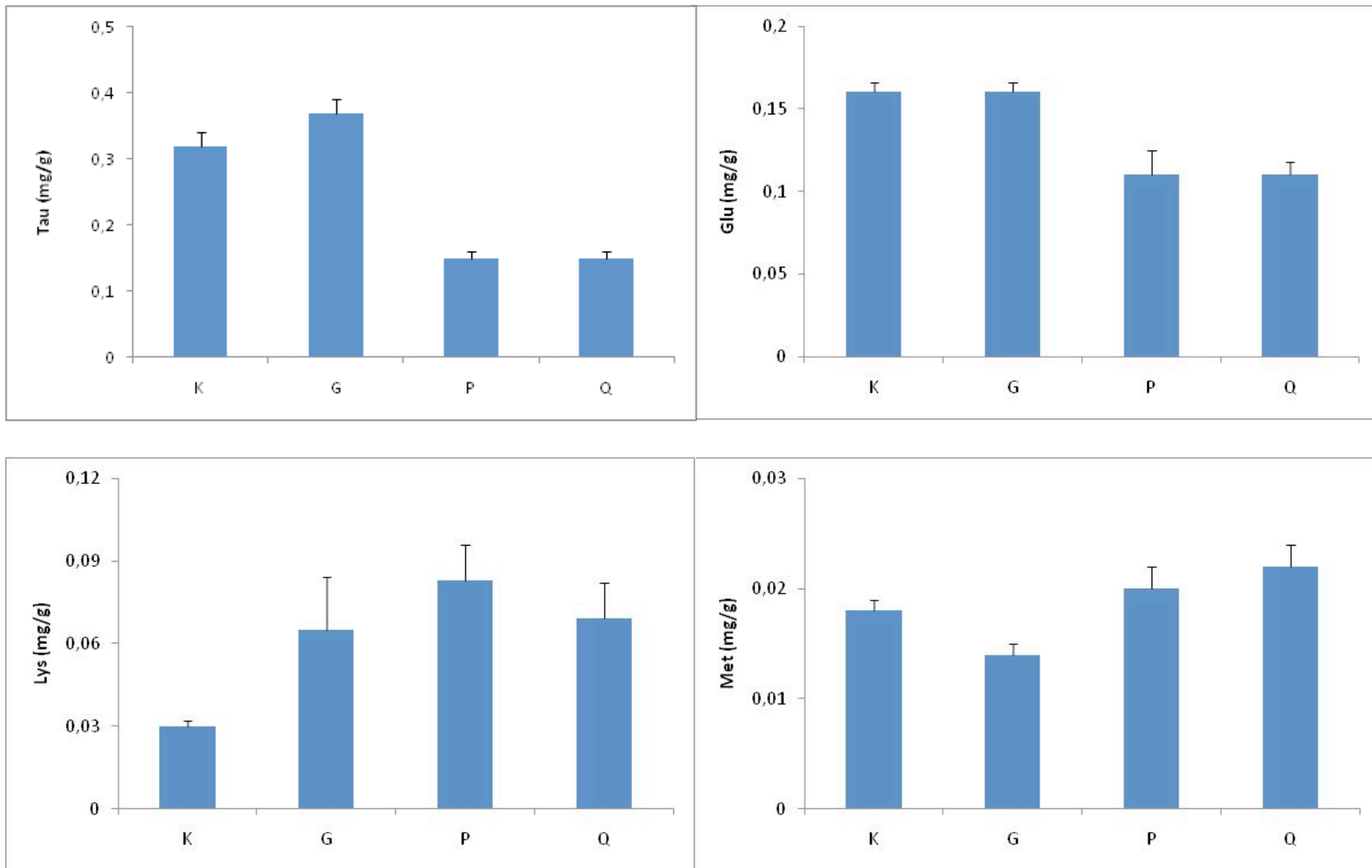
# Bindevev ulike lokaliteter



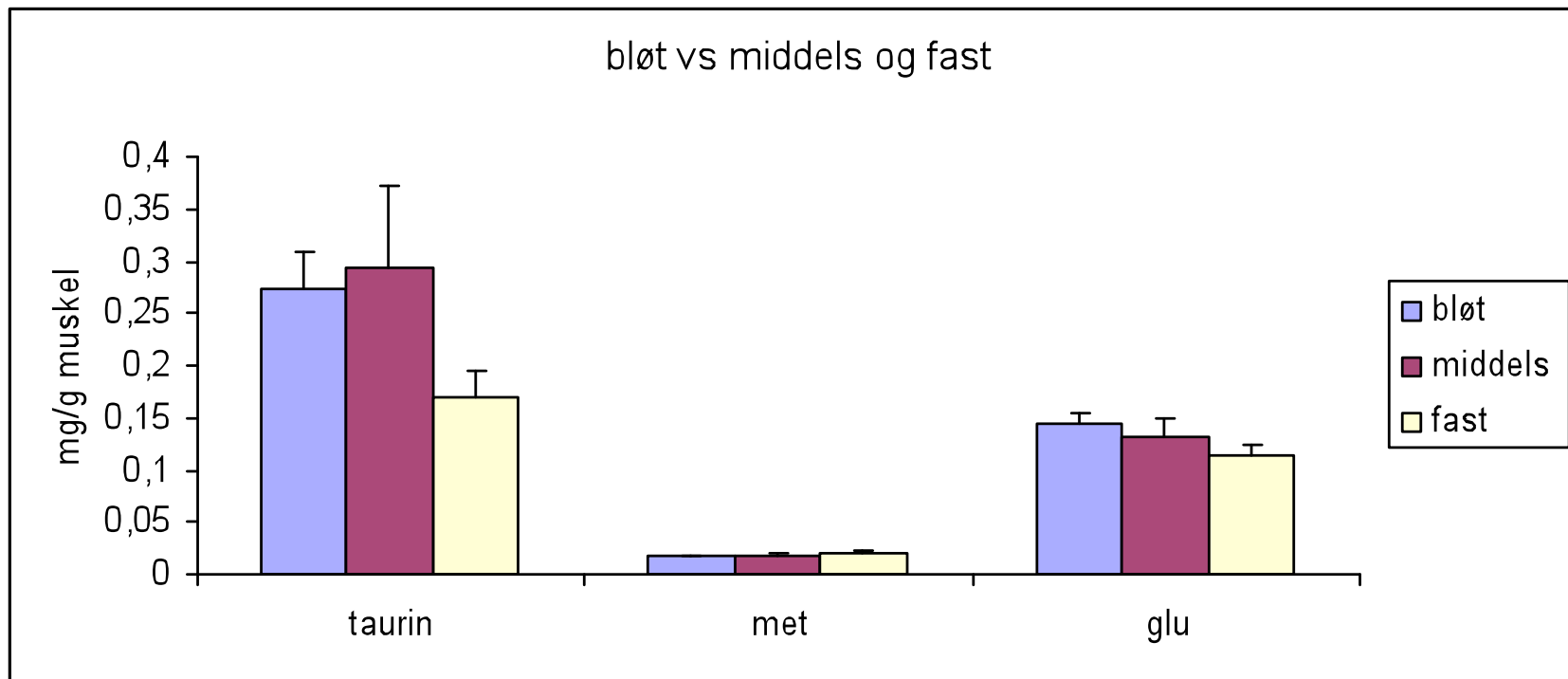
# Total collagen ikke påvirket ved bløthet



# AA og metabolitter ulike lokaliteter



# Mean taurine, metionin og glutamat i bløt vs middels vs fast tekstur:

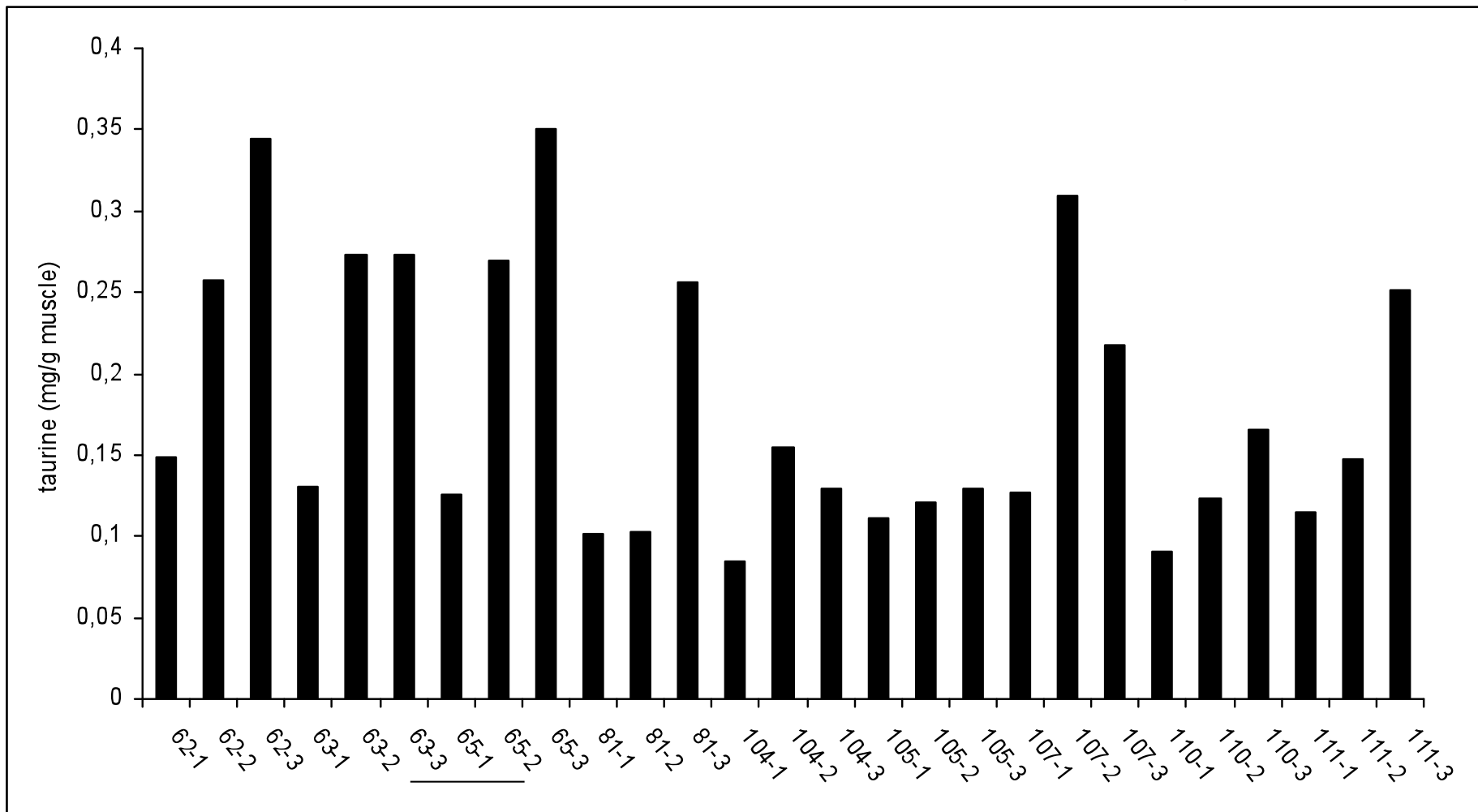


Bløt er 11 fisker

Middels er 3 fisker

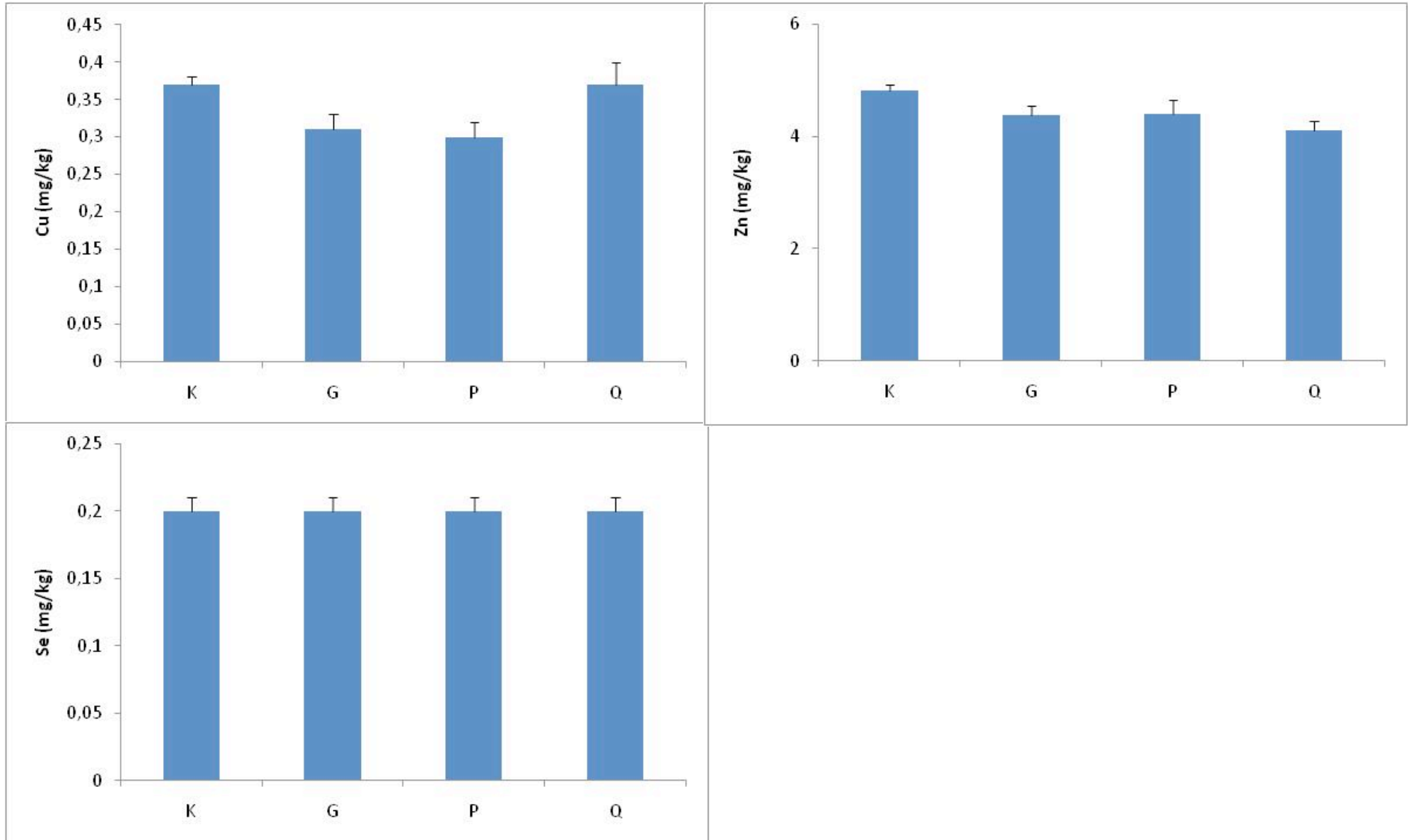
Fast er 6 fisker

# Taurin i ulike område av laksemuskelen, stor variasjon

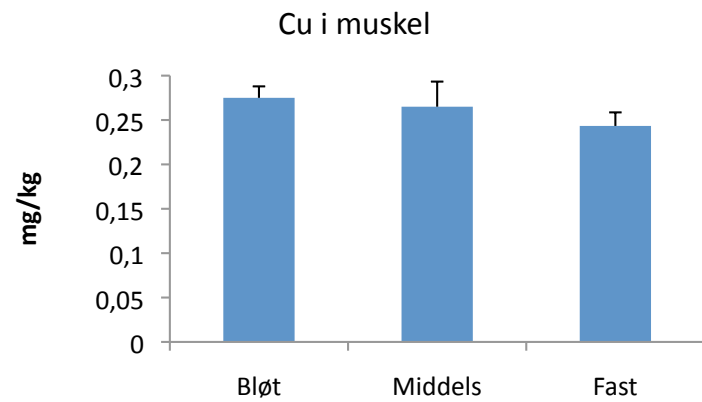
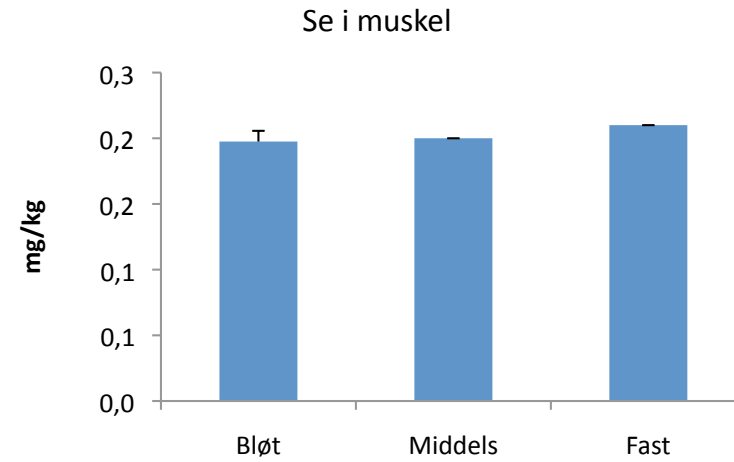
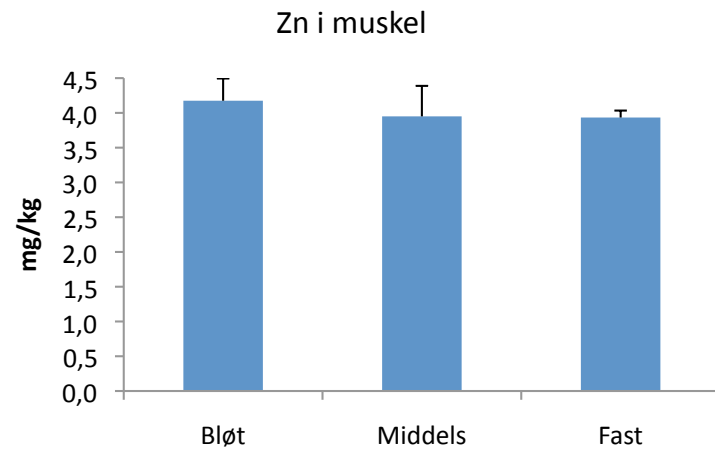


1 er foran ryggfinnen, 2 er sidelinja rett ovenfor gattet, 3 er bløt stripe

# Mineraler ulike lokaliteter



# Mineraler (Zn, Se & Cu)

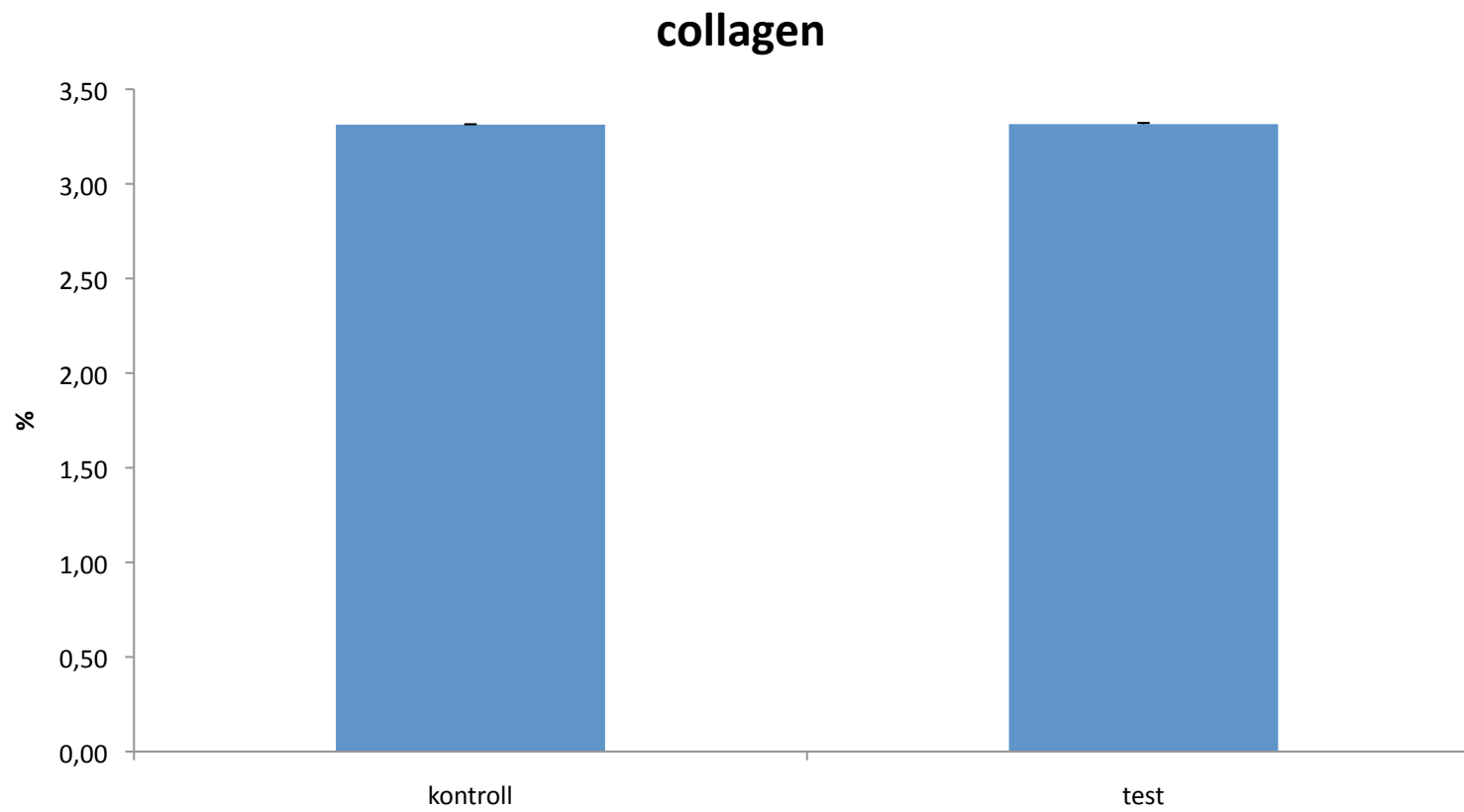


# Forsøk ved NOFIMA

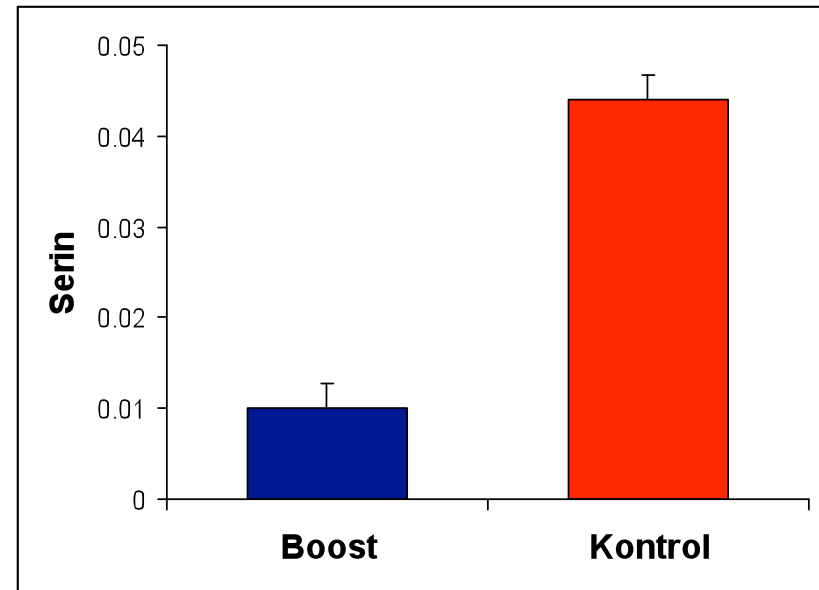
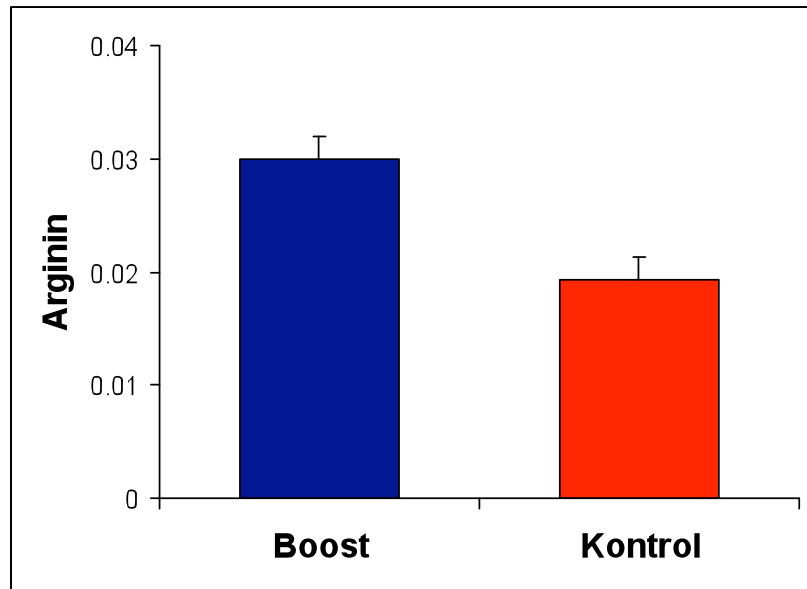
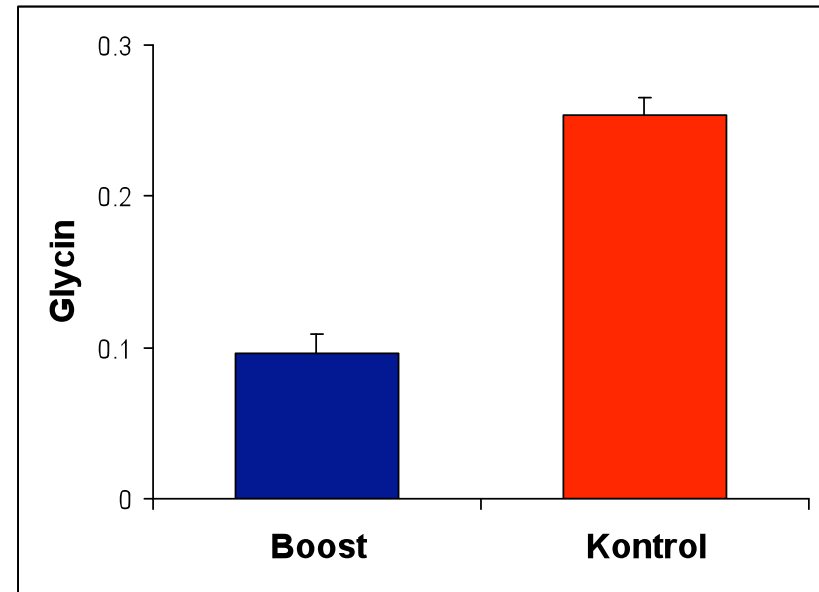
- Muskelprøver tilsendt fra forsøk i NOFIMA
  - Kontroll vs "boosted"
- Prøver fra NQC
  - Total collagen
  - Aminosyrer og Metabolitter
  - Mineraler (Zn, Se & Cu)
- Gått i merder (triplikater, 5 fisk pr merd analysert)

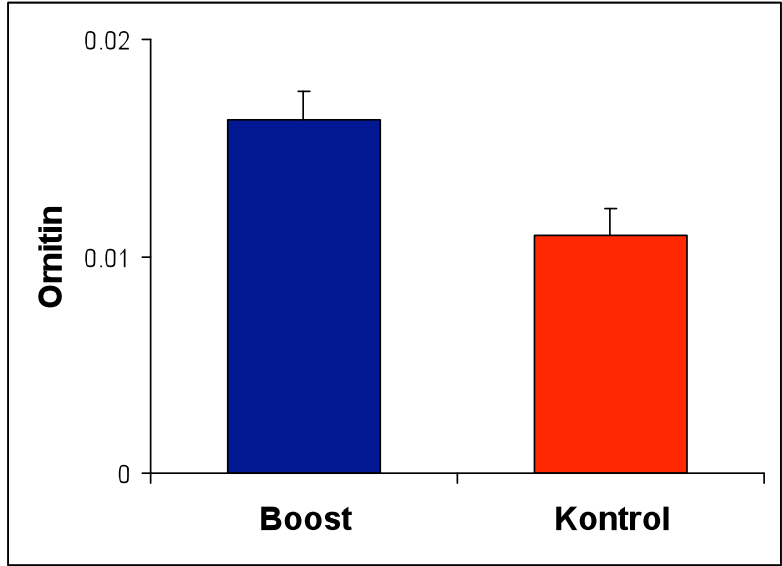
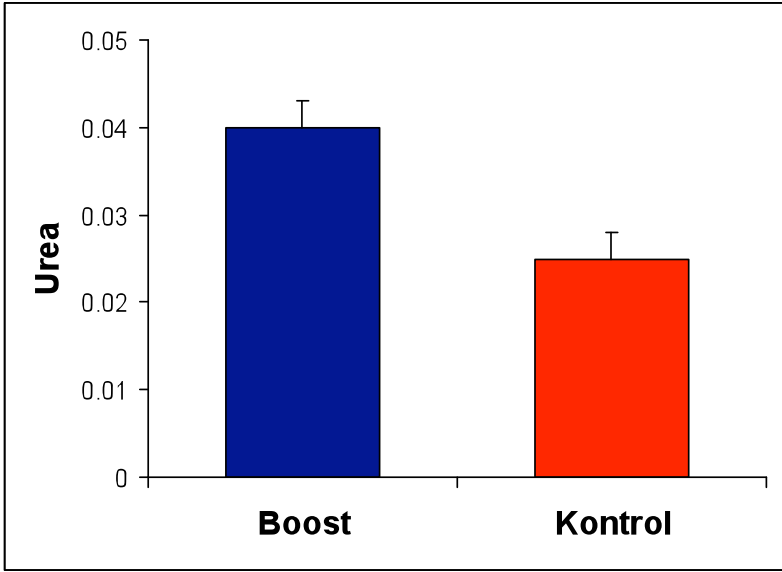


# Total collagen



# Frie aminosyrer i muskel

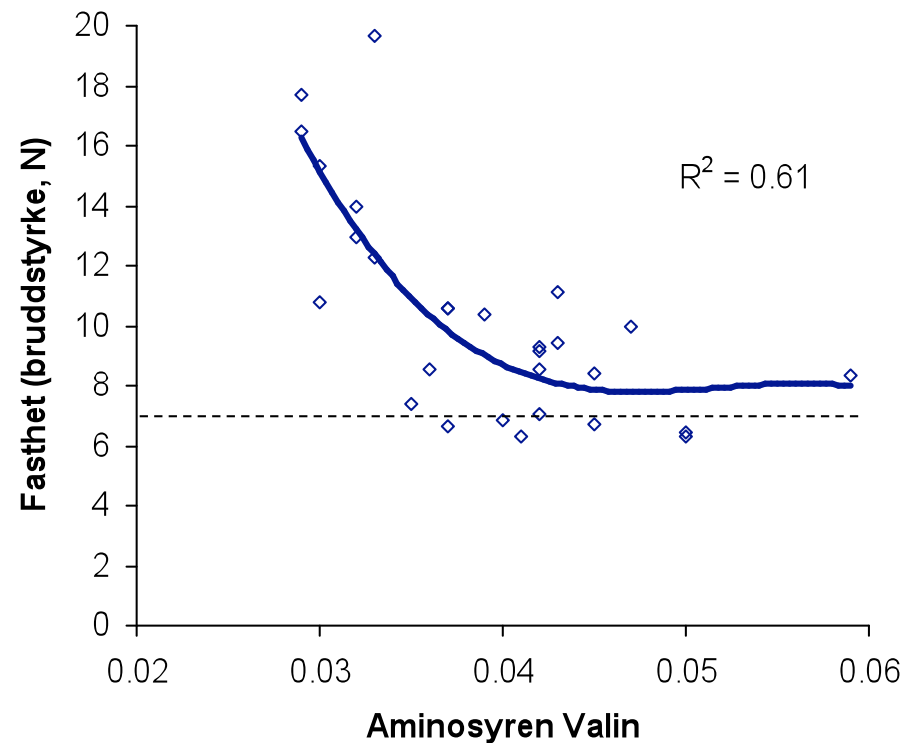




# Fasthet vs mengde frie aminosyrer i muskel

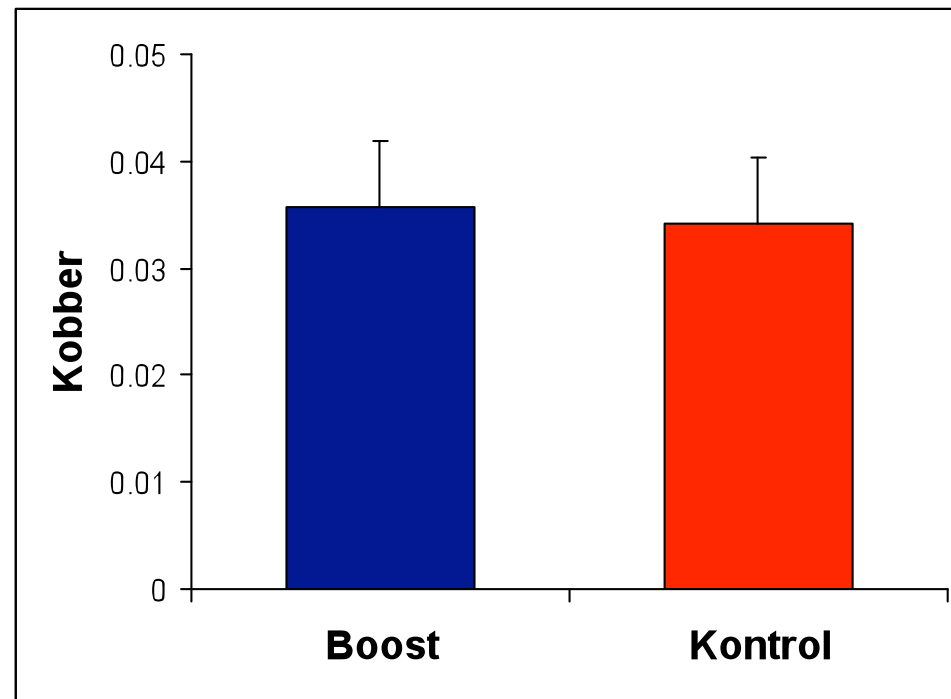
<u>Aminosyre</u>	<u>Korrelasjon*</u>
Val	-0.75
β-Ala	-0.69
Ile	-0.66
Asp	-0.62
Leu	-0.61
1-methyl-His	-0.61
Met	-0.53
Phe	-0.5
Glu	-0.43
Tau	-0.4
Phosphoetanolamin	-0.38
Tyr	-0.32
Thr	0
Glu	0

Jo mer frie AA desto bløtere muskel



\*Kraft ved 60% nedtrykk, n = 30

# Mineraler ingen forskjell

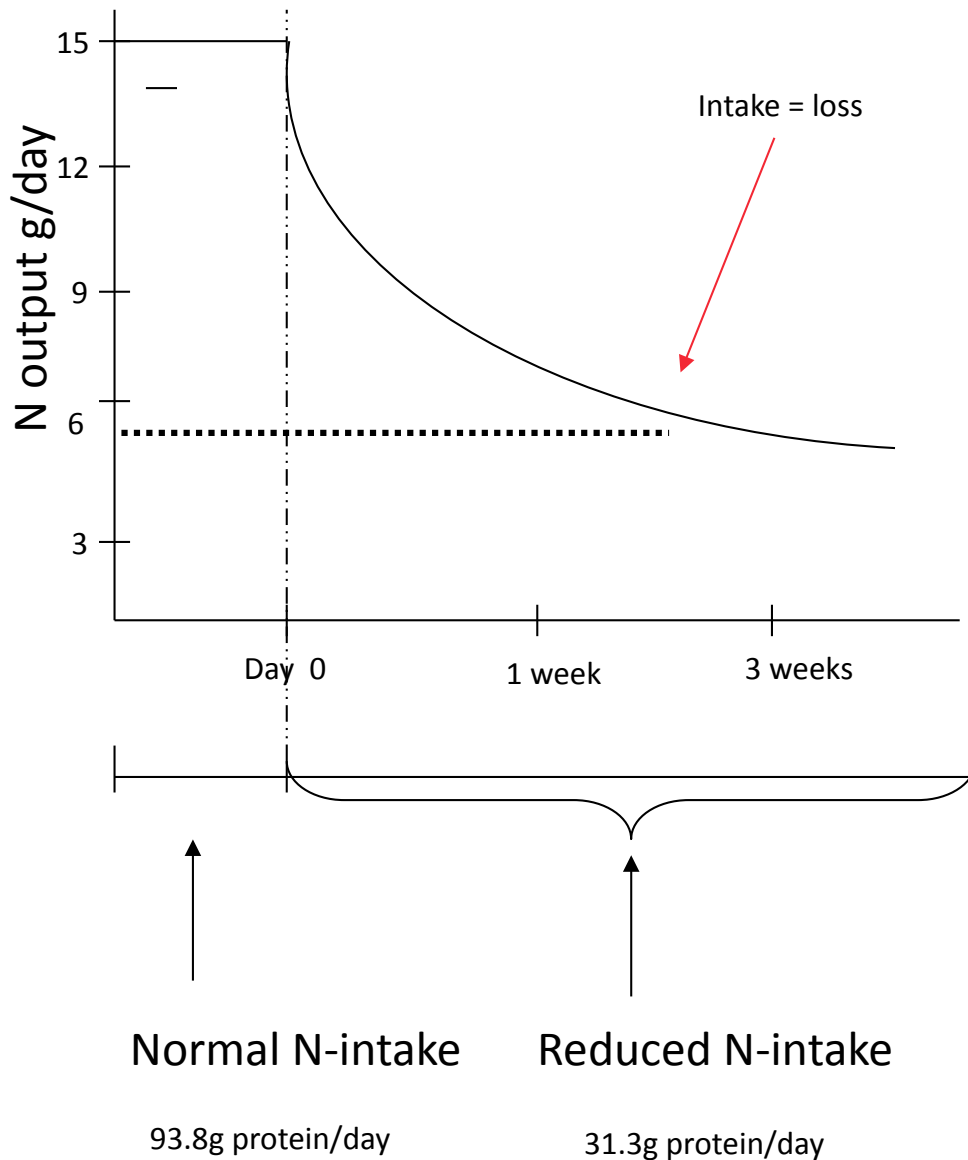


# Konklusjon

- Total mengde bindevev synes ikke å være endret
- Tidligere sett at Cu og Zn er relatert til bløthet
  - Ikke signifikante endringer i mineraler
- Det er en korrelasjon mellom frie aminosyrer og bløthet
  - Jo mer frie aminosyrer, jo bløtere fisk
- Økt nedbrytning av protein
- Endret membranstabilitet???

# Hele metabolismen må studeres

- Kan det være en ubalanse i næringstoffer?
- Livsviktige organ prioriteres
  - Lever, hjerte, hjerne, nyre
- Muskelen er et "stort lager" stor tilpasningsevne
- Hvordan mangel signaliseres er derfor viktig
  - Reseptorer, transportører, kjernereseptorer etc
- Tilgang på metabolitter/osmolytter
  - Bør sees i sammenheng med endret føringredienser (-taurin, endret AA-ratioer/profiler)
- Eventuell "mangel på metabolitter" og funksjonaliteten av muskelen
  - Bør studeres mer systematisk og sees i sammenheng med strukturelle endringer og bløthet



The 70 kilo man is fed 93.8g protein/daily (15g N)

On day zero his protein intake is being reduced to 31.3g protein/daily (5g N)

What will he do to adapt to this new situation?

Negative N-balance

Reduce his Urinary N output

Approximately 1 week later he has reduced

his urinary N to the obligatory loss

$U_N$ =obligatory loss in a 70 kilo man is

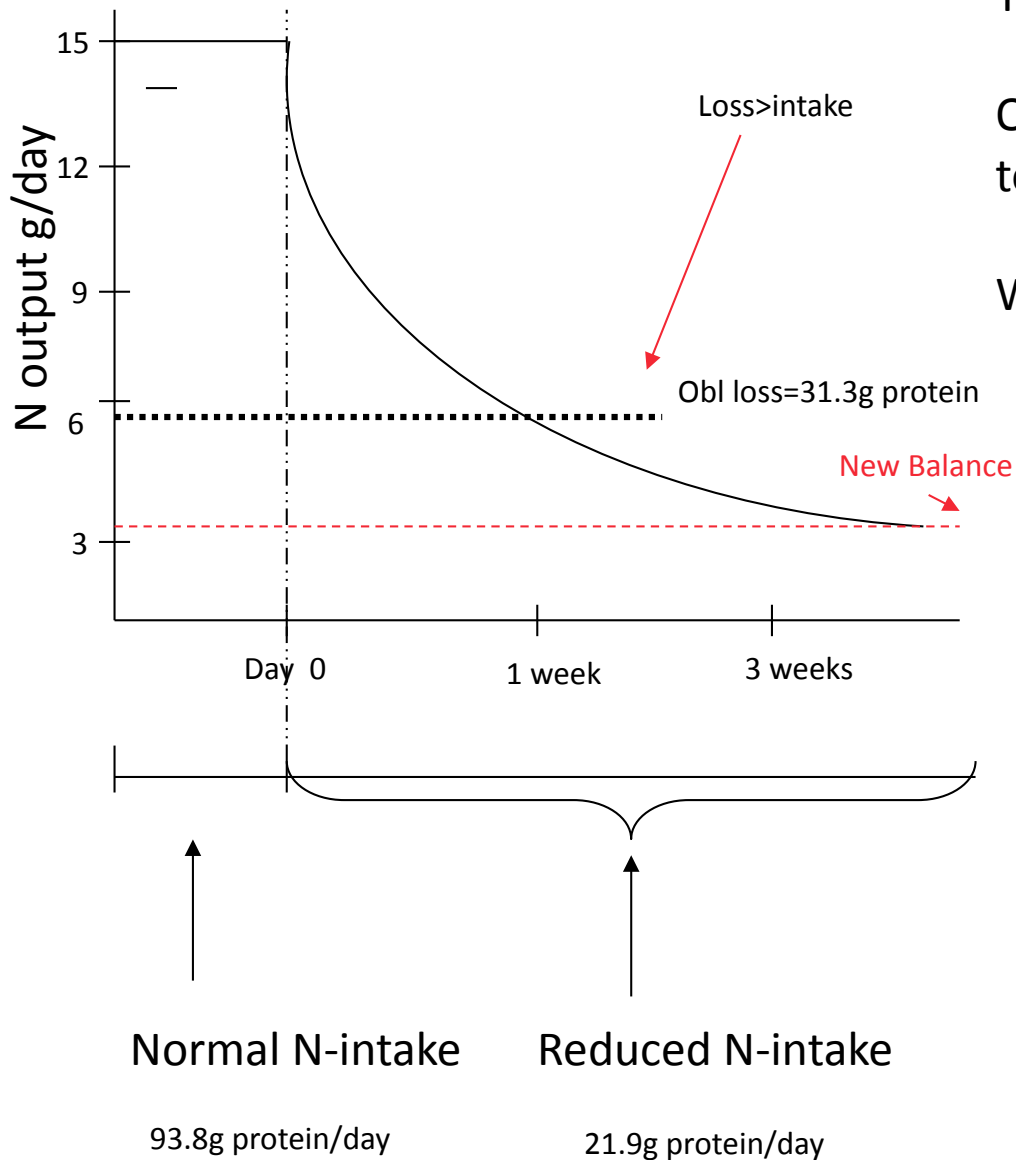
**70mgN/kgBW/day**

$70\text{kg} \times 70\text{mgN} = 4900\text{mgN}$

$(4.9\text{gN} \times 6.25 = 31.3\text{g protein})$

A new N balance has been established





The 70 kilo man is fed 93.8g protein/daily

On day zero his protein intake is being reduced to 21.9g protein/daily (3.5g N)

What will he do to adapt to this new situation?

**During first week reduce the urinary loss to a minimum =31.3g protein  
Eats less than obligatory loss, neg Bal  
after 1 week of  
31.9g-21.9g= 9.4g protein**

**What will happen???**

Has to loose weight to reduce obligatory loss  
 $70\text{mgN/kgBW} \times x\text{kg} = 1.504\text{gN}$   
 Loose 21 kilo BW  
 BW=49kg

**A new N balance has been established,  
but is it an adaptation as lost 21 kilo reduced**