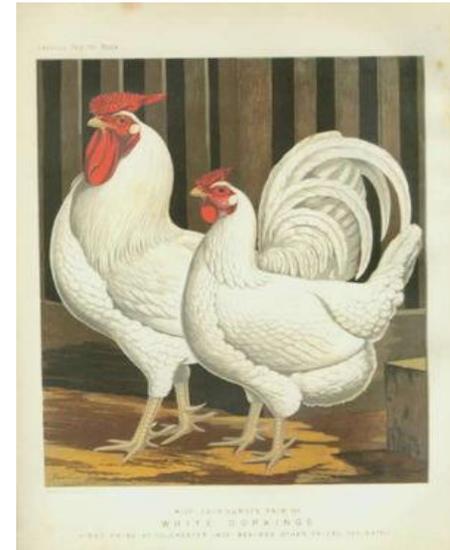


Meat and health: How to improve the nutritional quality of meat

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Abstract no 10301



Objective

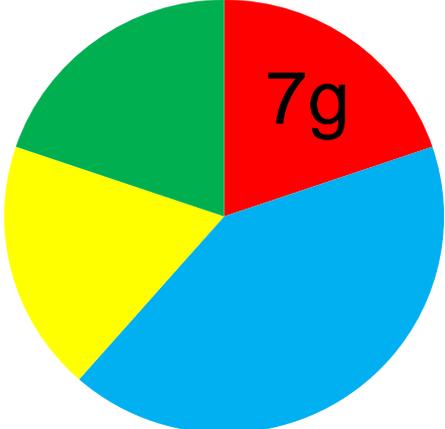
- A future ambition is that all meat should have a nutrient composition that is optimal for the consumers.
- **Omega-6 and 3:** The goal of healthy meat can be achieved if the feed given to domestic animals contains more omega-3 fatty acids and less omega-6 than now.
- **Selen** (organic form) can be added to the feed so that selenium concentration in meat equals fish.



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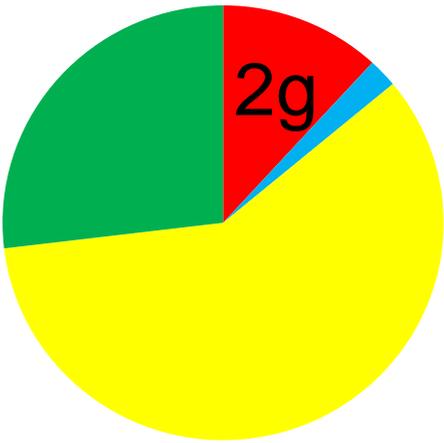
Fat from meat: 19 g fat/person/day

Saturated fat



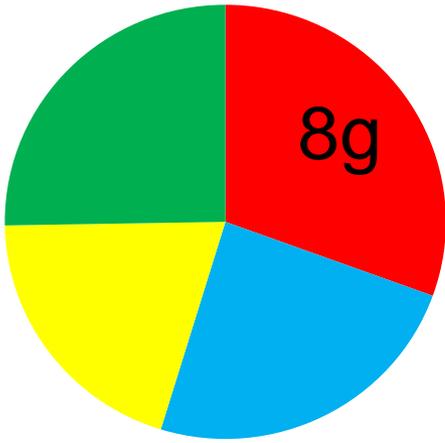
- Kjøtt, innmat
- Melk, fløte, ost, smør
- Margarin og annet spise fett
- Andre matvarer

Polyunsaturated fat



- Kjøtt, innmat
- Melk, fløte, ost, smør
- Margarin og annet spise fett
- Andre matvarer

Monounsaturated fat



- Kjøtt, innmat
- Melk, fløte, ost, smør
- Margarin og annet spise fett
- Andre matvarer

Polyunsaturated fatty acids



- Oils contain plant sterols that inhibit cholesterol uptake in the intestine, and reduces total cholesterol in blood
- Have strong effects on membrane fluidity, transcription factors (PPAR, sterol regulatory protein), are substrates for enzymes (cyclooxygenases, lipoxygenases, cytochrome P450)
- Affects lipid metabolism, cardiac arrhythmia, platelet - and endothelial function, inflammation
- Increase oxidation of LDL and can be converted to mutagenic oxidation products

Polyunsaturated fat, PUFA

Two families:

n-6, omega-6

Linoleic acid

Arachidonic acid

n-3, omega-3

alpha-linolenic acid

EPA, DPA, DHA

n-6:

Linoleic acid:

Most oils,
margarine,
Cereals

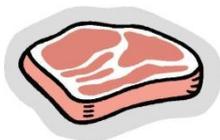


Feed concentrate



Aarachidonic acid:

Meat and offal's from
animals fed n-6



n-3:

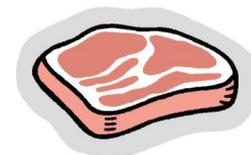
alpha-linolenic acid:

Grass, green
leaves, linseed,
rapeseed



EPA, DPA, DHA:

Fish and meat from
animals fed n-3





Linoleic acid
LA

(18:2 n-6)

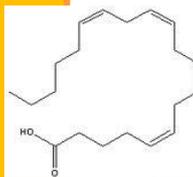


Alpha-linolenic
acid ALA

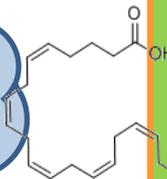
(18:3n-3)



Arachidonic acid
AA
(20:4 n-6)



Enzymes,
i.a. COX

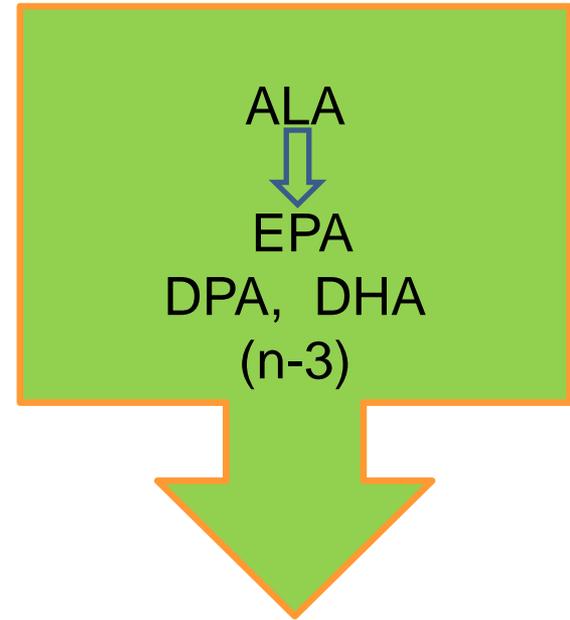
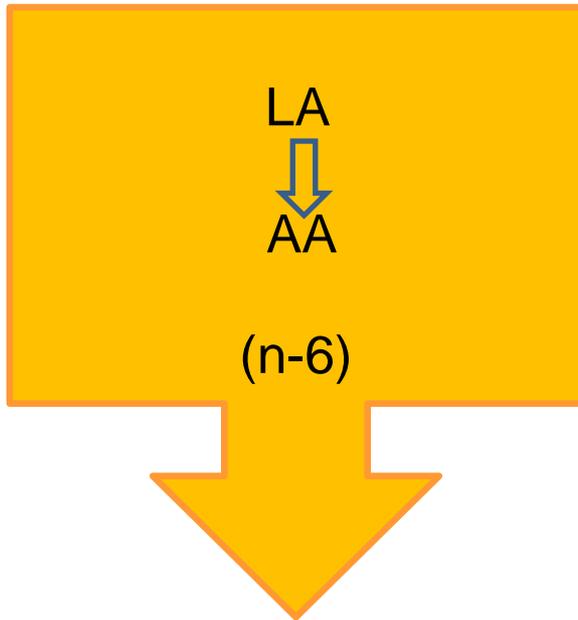


Eicosapentaenoic acid
EPA
(20:5 n-3)

Eicosanoids

Eicosanoids

Eicosanoids with different effect on thrombosis, blood pressure,
inflammation, allergy



COX
LOX
CYP450
(and it is a competition)

2-series prostaglandins
2-series thromboxanes
4-series leukotrienes
Lipoxins
Hepoxilins
Hydroxy fatty acids
Epoxyeicosatrienoic acids

3-series prostaglandins
3-series thromboxanes
5-series leukotrienes
Lipoxins
Hepoxilins
Hydroxy fatty acids
Epoxyeicosatrienoic acids

Proinflammatory , Proaggregatory
Thrombosis,
Sensitize pain fibres
Smooth muscle contraction
Stimulation of angiogenesis

Antiinflammatory
Antiaggregatory
Vasodilatory

**Too much n-6
(linolic acid,
arachidonic
acid)**

Unbalanced diet:

**Too little n-3
(alpha-linolenic
acid, EPA, DPA,
DHA)**



**Inflammation,
thrombosis,
cardiac diseases,
reduced anti-
cancer immune
defense, activation
of pain fibers,
contraction of
smooth muscles,
stimulation of
angiogenesis**



**Antiinflammation
Antithrombosis
Reduced blood
pressure**



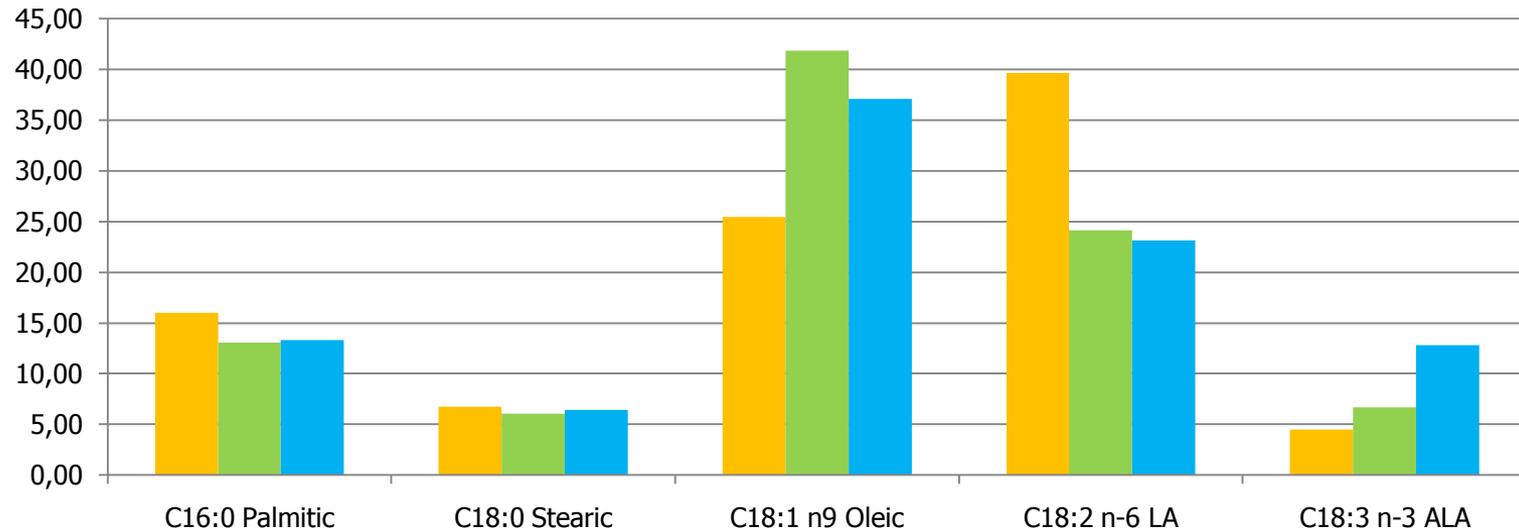
It is claimed: "You become what you eat"

**This is especially true
for fat**

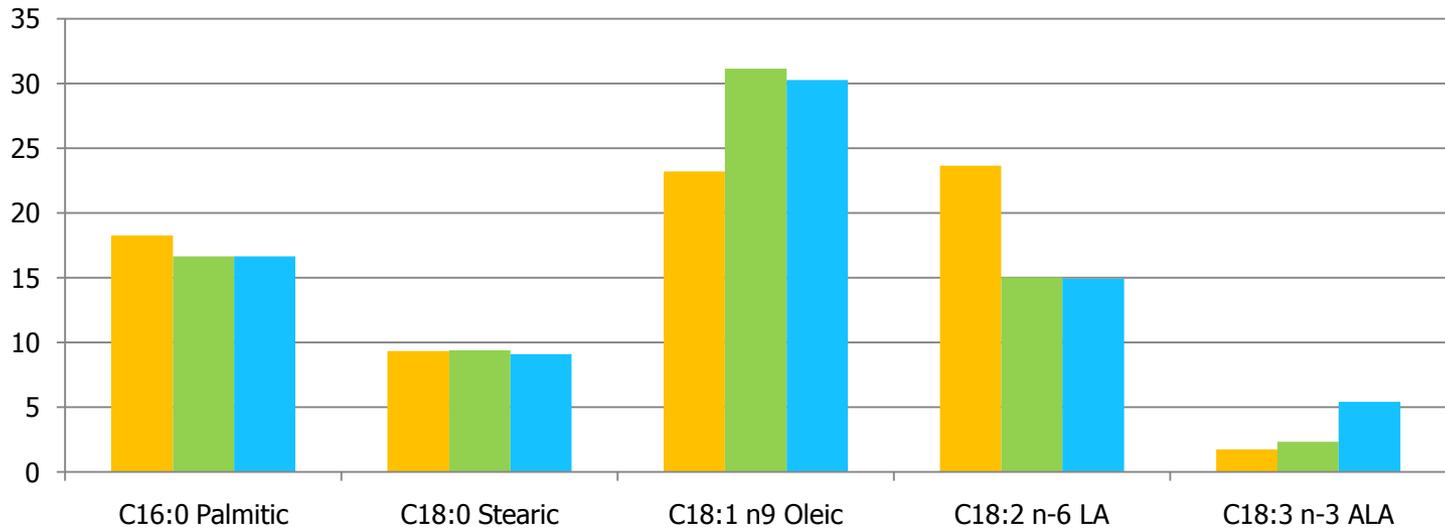
**The composition of
meat is to a large
extent depending on
the feed composition.**



Fatty acid composition in chicken feed.



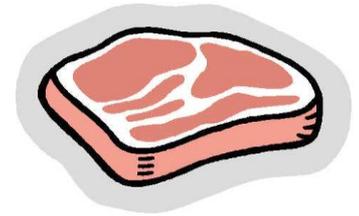
Fatty acid composition in chicken muscle.



The 'fish fatty acids', EPA, DPA, DHA

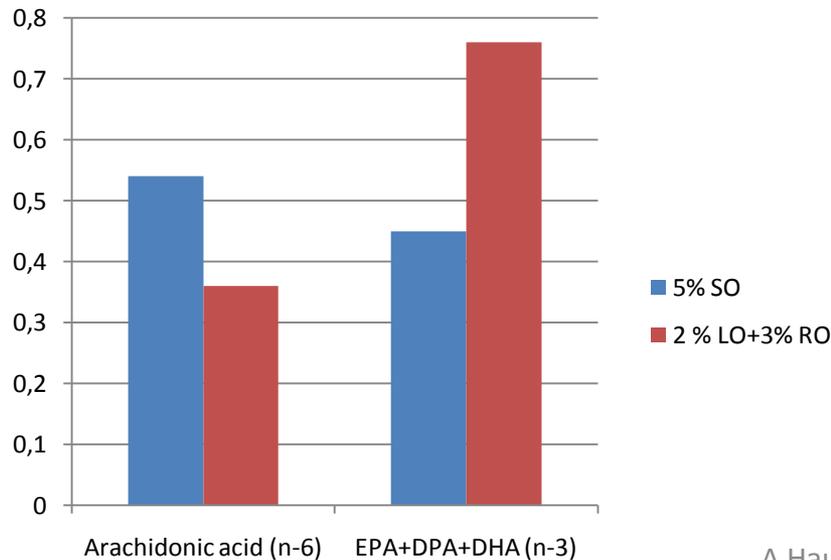
- The long chain n-3 fatty acids **EPA**, **DPA** and **DHA** are often called the 'fish fatty acids',
- but in fact they are also found in meat from **grass-fed** animals, or animals given **n-3 rich oils**.

Meat is a good source of the long n-3 fatty acids if the animal are fed with alpha-linolenic acid (in grass, linseed rapeseed).

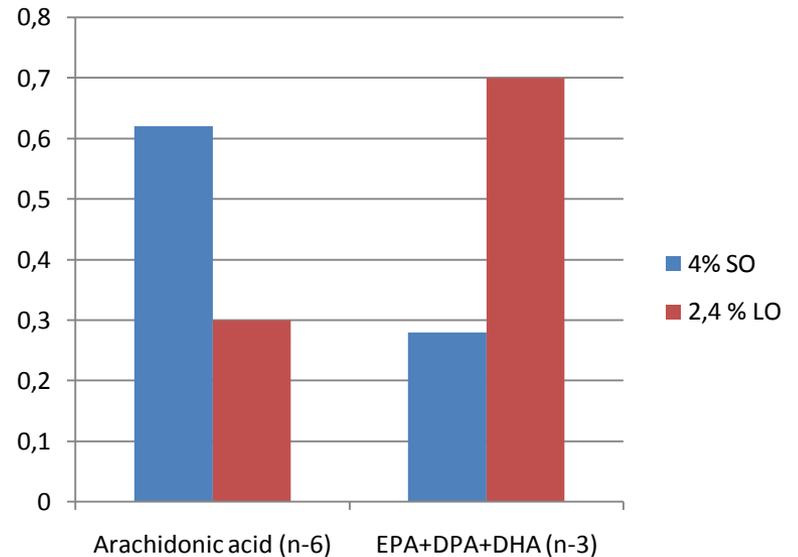


If we give linseed oil (red columns)
instead of soybean oil (blue) to broilers:
(two studies done at UMB/IHA):

g/kg muscle (F361)



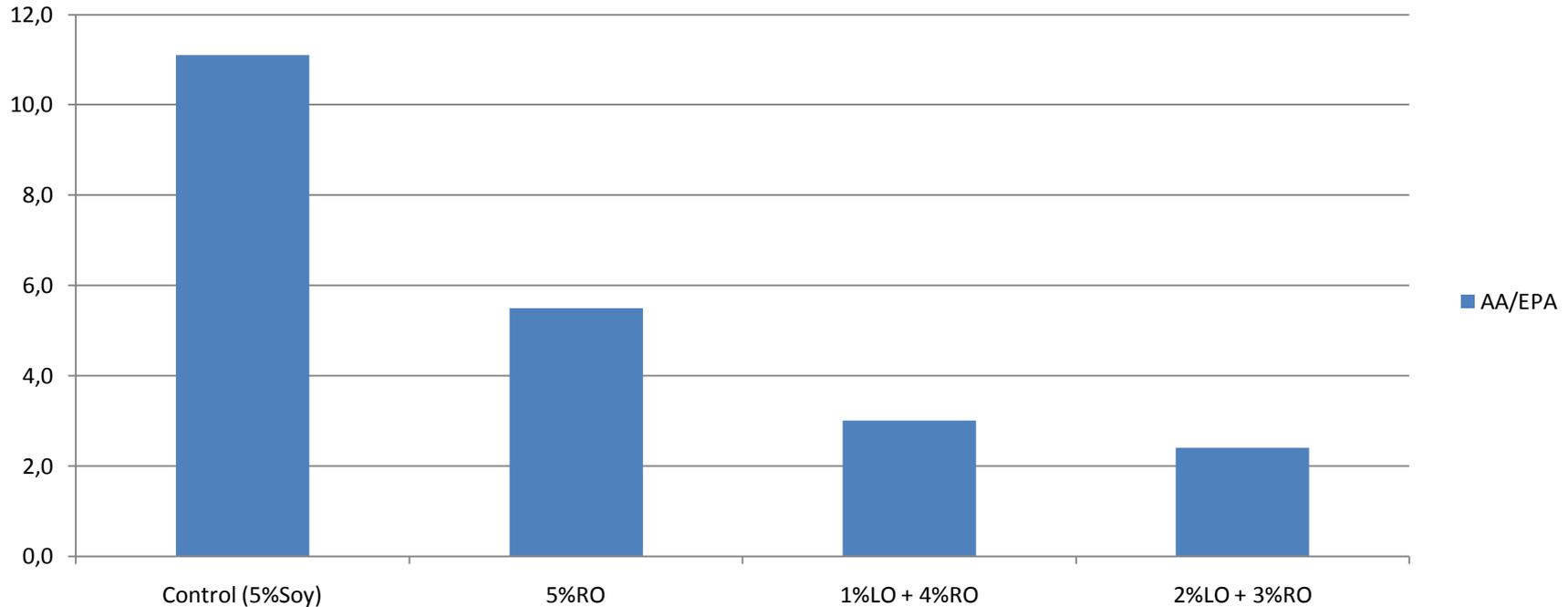
g/kg muscle (F 365)



Studies at IHA/UMB: Ratio between AA and EPA in broiler meat given soybean oil (5%), rapeseed oil (RO) and linseed oil (LO) in the feed concentrate

The ratio in the column at left is when the feed is supplemented with 5% soybean oil, and to the right when supplemented with 2% linseed oil and 3% rapeseed oil

AA/EPA

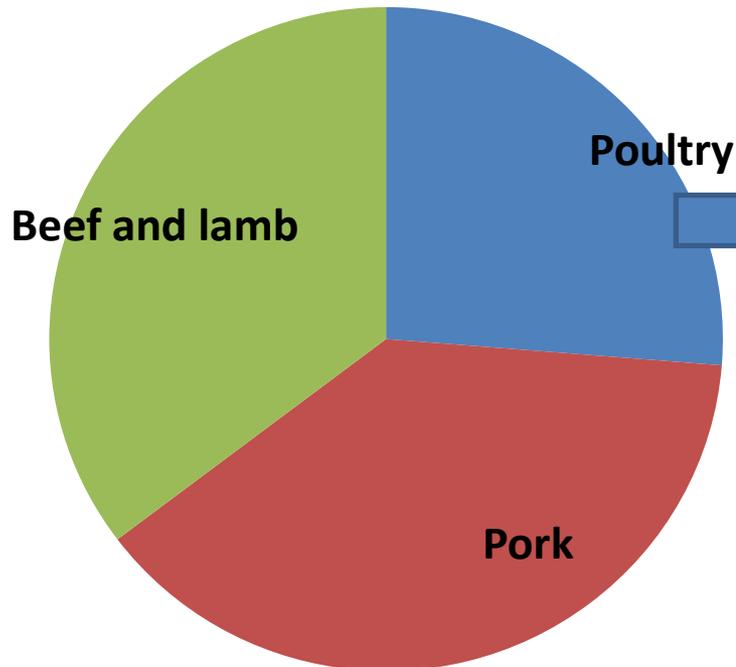


Today

Soon?

If our broilers were given linseed plus rapeseed oil instead for soybean oil, the increased intake of EPA and DHA from broiler meat corresponds to 1/3 cod dinner/week

Total meat intake: 850 g/week



Estimate: If all livestock were given rapeseed and linseed oil or grass it could correspond to extra EPA+DHA equal to 1-2 cod dinners /week

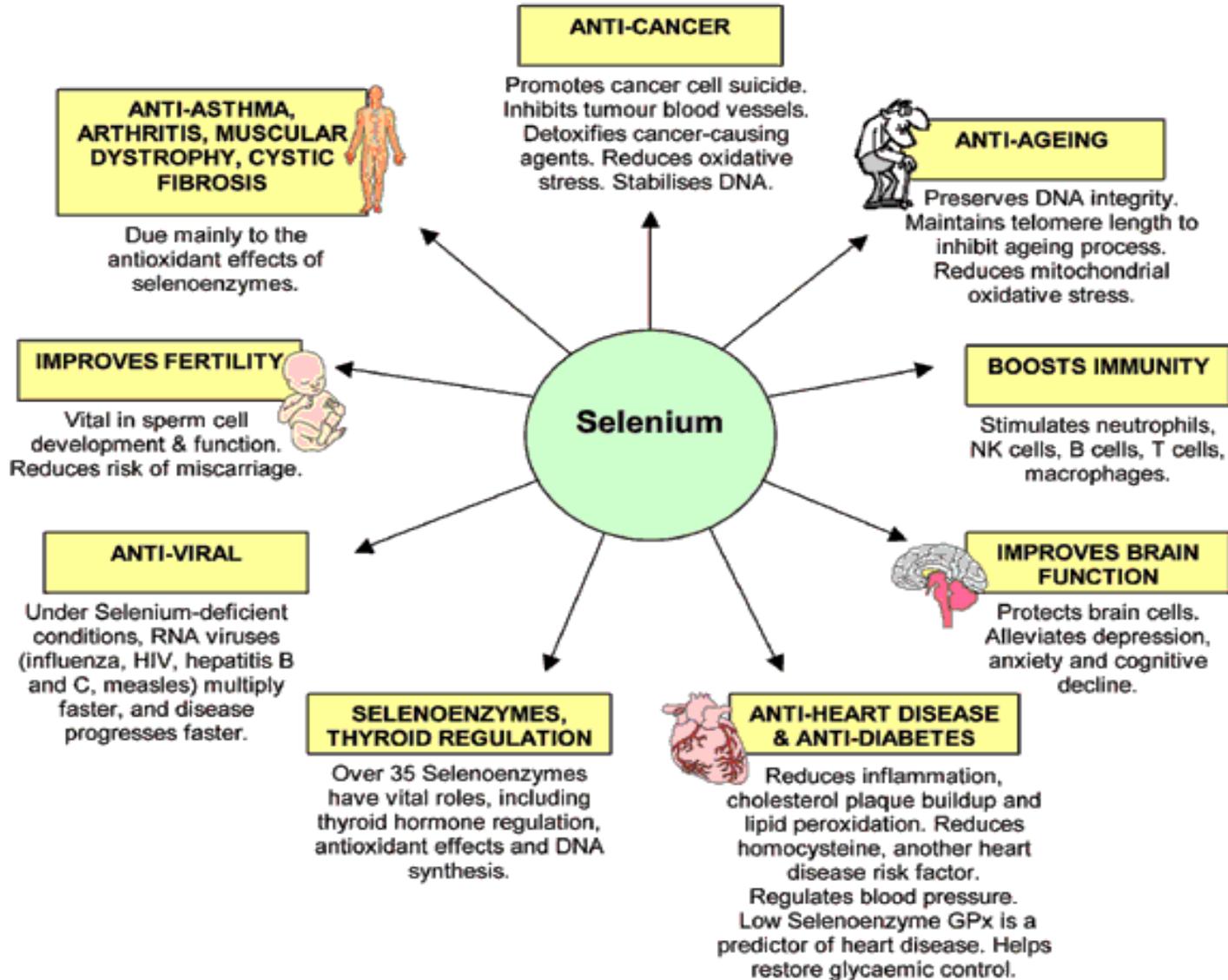
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Taste

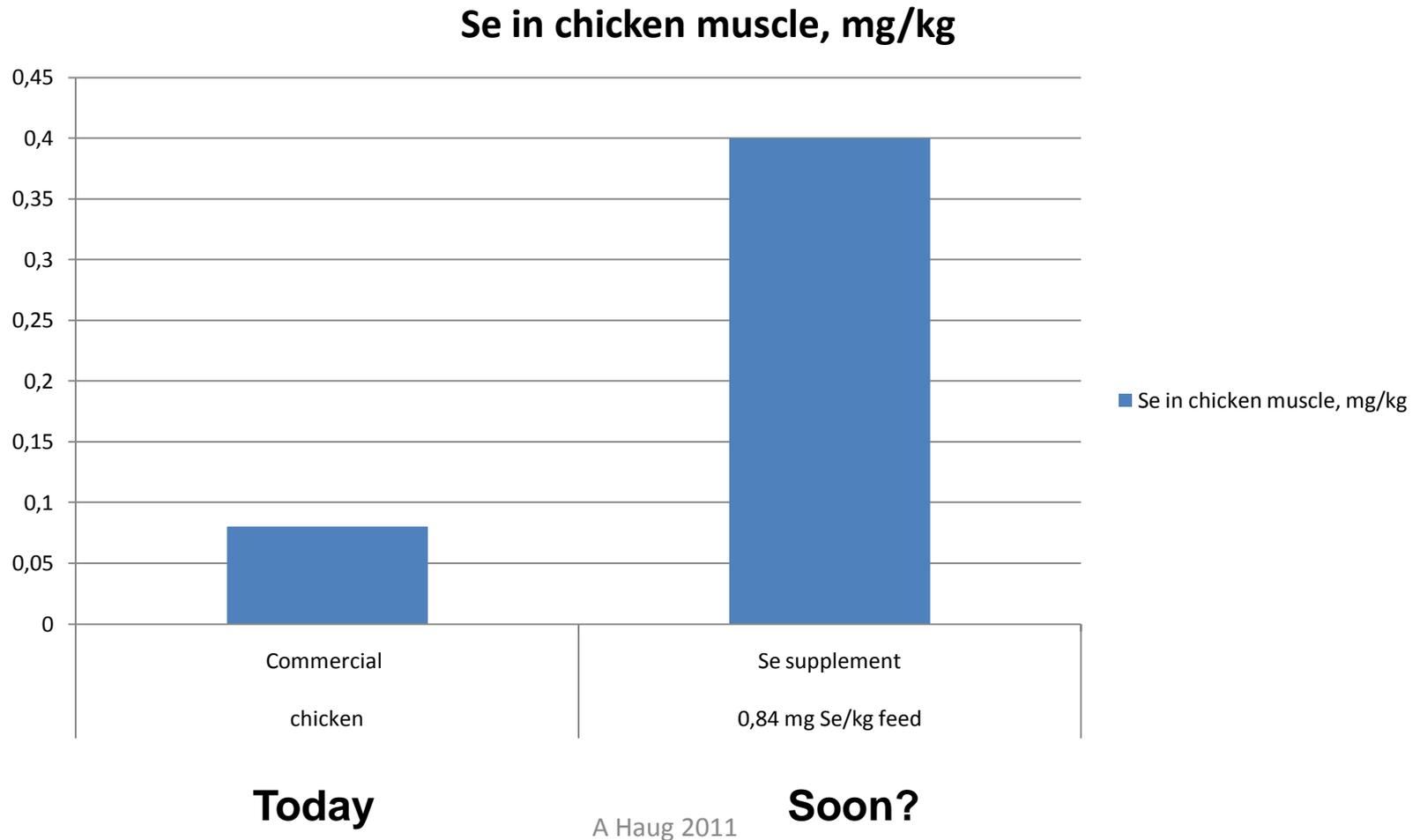
- **The taste and sensoric parameters of the meat were not different when rapeseed- linseed oil and selenium were added to the feed**



The Health Benefits of Selenium.



Study at IHA/UMB: Selenium in chicken muscle can be increased to the same level as in fish by adding organic selenium to the feed concentrate



Why improve meat? Why not eat fish instead of meat ?

- Fish is a limited resource in the world.
- The production of fish and fish oil will not be increased as to cover the expected needs.
- Many prefer eating meat instead of fish
- **THUS: We have to improve the meat composition in the direction of supplying us with the important nutrients that is abundant in fish**

Every step in improving meat counts:

- **More EPA, DPA ,DHA and less arachidonic acid in meat**
- **More selenium in meat**

Conclusion

1. The feed should be lower in linoleic acid (less soybean oil) and higher in alpha-linolenic acid (more rapeseed oil, linseed oil, grass)
2. Suggest a new legislation: all meat should have a good n-6/n-3 ratio.
3. Suggest that arachidonic acid in meat should not exceed a certain maximum level
4. Add organic selenium to the feed so that selenium concentration in meat is the same as in fish

Referenses

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- **Haug A, Eich-Greatorex S, Bernhoft A, Hetland H, Sogn T. Selenium bioavailability in chicken fed selenium fertilized wheat. *Acta Agri Scand A Animal Sci.* 2008;58:65-70.**
- **Haug A, Rødbotten R, Mydland LT, Christophersen OA. Increased broiler muscle carnosine and anserine following histidine supplementation of commercial broiler feed concentrate. *Acta Agri Scand A Animal Sci.* 2008;58:71-77.**
- **Haug A, Olesen I, Christophersen OA. Individual variation in arachidonic acid and eicosapentaenoic acid in chicken muscle. *Lipids in Health and Disease.* 2010;9:37-48.**
- **Christophersen OA, Haug A. Animal products, diseases and drugs: a plea for better integration between agricultural sciences, human nutrition and human pharmacology. *Lipids in Health and Disease.* 2011, 10:16.**

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Animalia v/Tone B Hansen and Kristian Hoel.



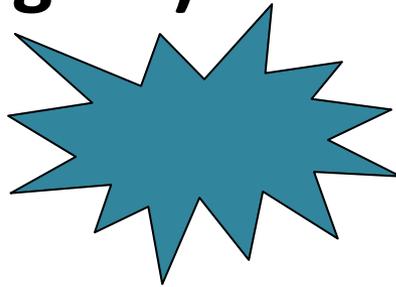
Thank you for your attention.



Health sector

- We well have to make the health sector more cost-effective:
- Prevention of common chronic diseases (CHD, cancer, allergies)

HOW?



- Lower n-6/n-3 ratio in food (meat), less arachidonic acid (n-6) and higher selenium, will contribute to better human health

Competition among the fatty acids:

- **Linoleic acid is also a powerful antagonist to EPA and DHA.**
- **It is claimed that the requirement for EPA and DHA varies with a factor of 10 according to linoleic acid intake,**
- **and that the main reason to poor EPA and DHA status in the US population from 1900 is not primary a reduction of EPA and DHA, but rather the tremendous increase in intake of linoleic acid.**

