

Fish proteins and peptides - beneficial effects on human health and possible industrial use

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Is fish consumption beneficial for human health?? If so, how come?

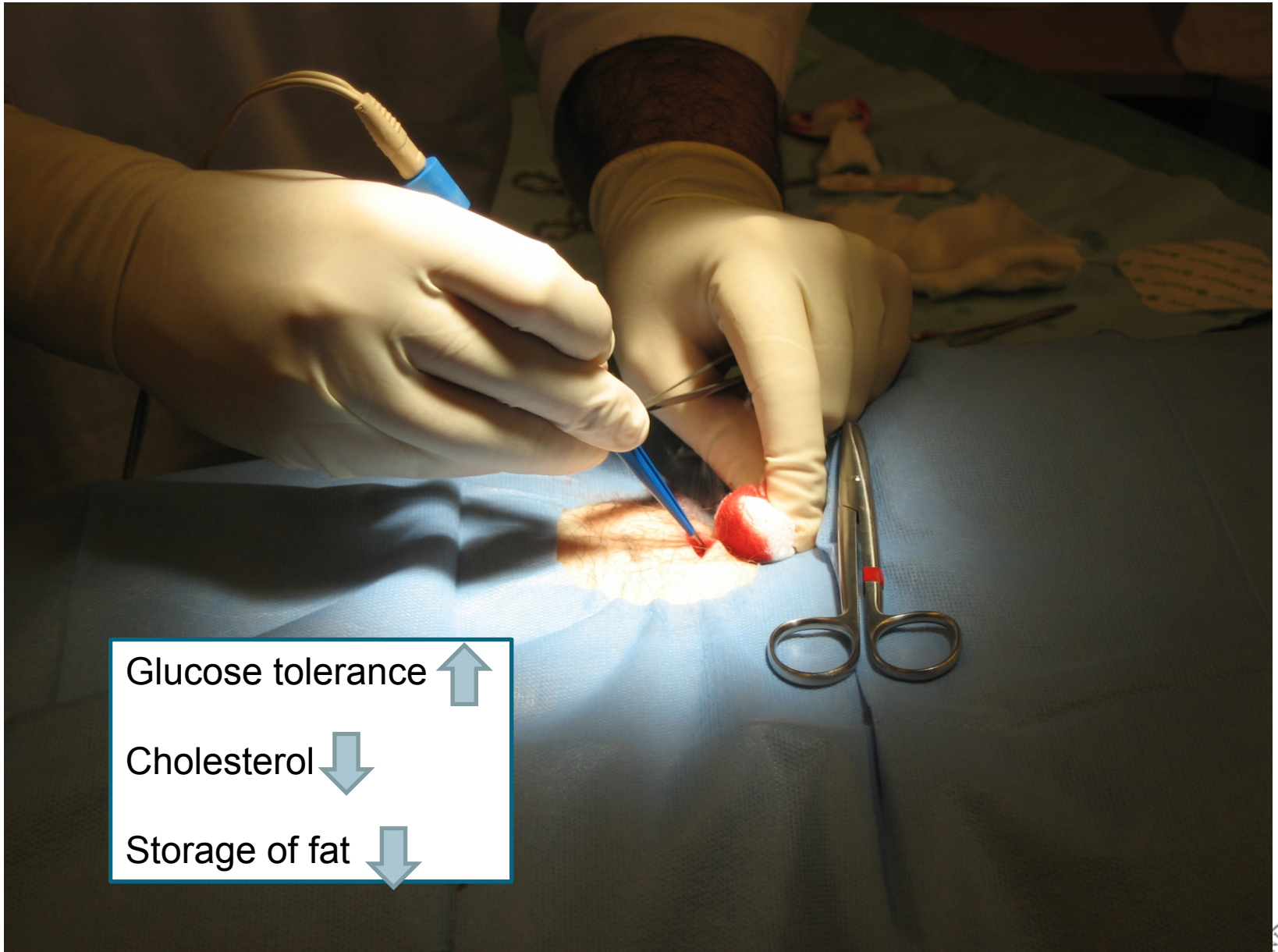
- Numerous trials using fish oil has been conducted in both humans and animals, but very few scientific studies have been conducted to investigate the effects of fish filet or fish protein intake in humans
- Health benefits of eating fish could be caused by e.g.
 - long chain omega-3 fatty acids EPA and DHA
 - Nutrients such as vitamin D and selenium
 - High protein content

Project on bariatric surgery and fish intake

- Funded by Bergen Medical Research Foundation
- Finishes 30th September, 2013
- Resulting in 16 Master thesis and approx 10 publications

- What are the common biochemical, hormonal and physiological changes after bariatric surgery and fish intake in adult humans?

- Will we be able to mimic the changes seen shortly after bariatric surgery by treating obese and overweight adults with fish or fish proteins?



Glucose tolerance ↑
Cholesterol ↓
Storage of fat ↓

Salmon peptides



Cholesterol ↓

Storage of fat ↓

Fecal lipids ↑

Obesity

- reduces life expectancy and life quality
- predisposes for a wide range of diseases, such as
 - cardiovascular disease
 - type 2 diabetes and reduced insulin sensitivity
 - colon cancer
 - non-alcoholic fatty liver disease
 - hypertension
 - gallbladder disease
 - chronically low-grade systemic inflammation
 - reduced immune function

Cod protein supplementation

A randomised study on the effects of fish protein supplement on glucose tolerance, lipids and body composition in overweight adults

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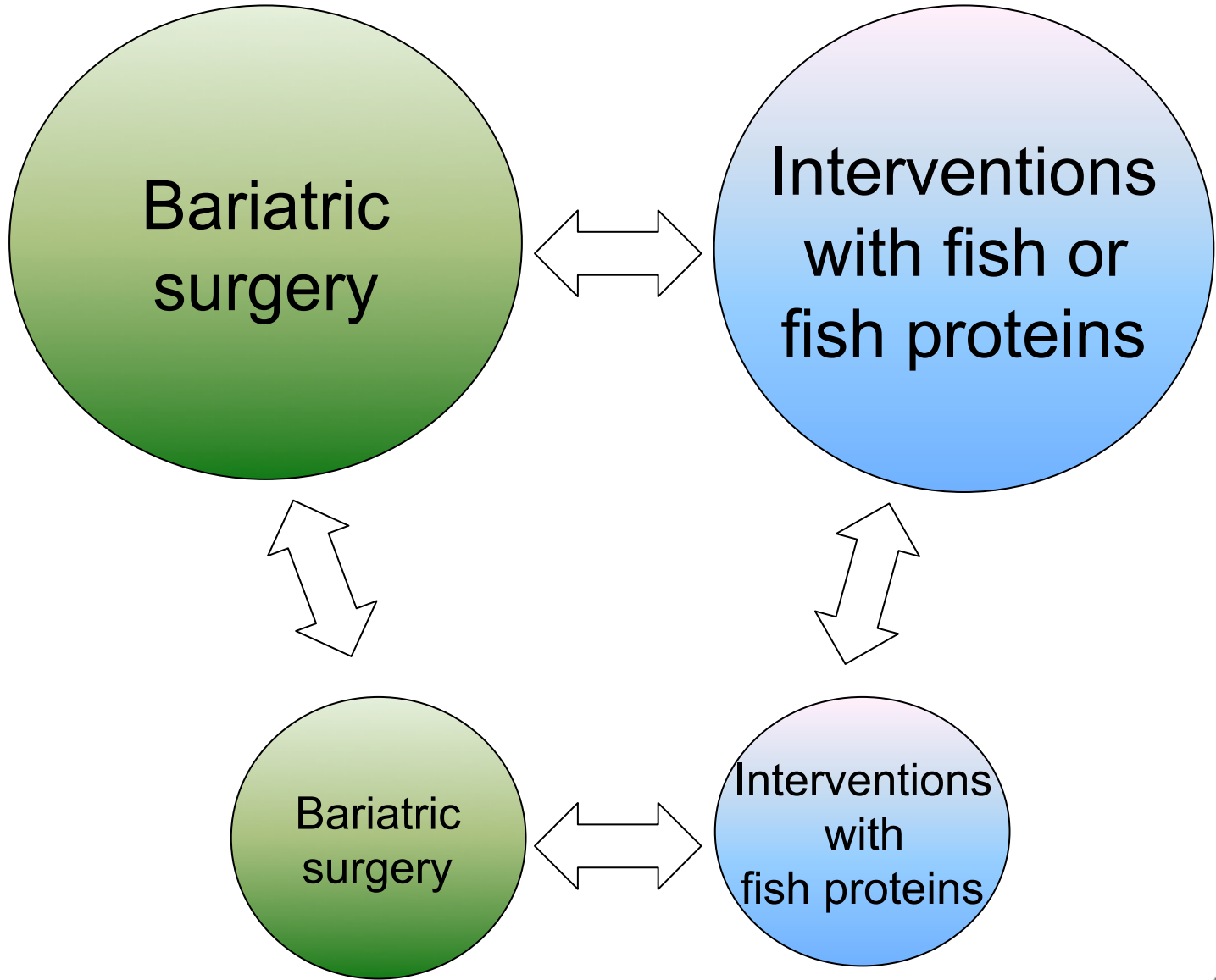
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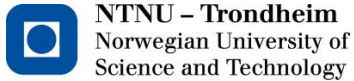
(Submitted 21 November 2011 – Final revision received 29 February 2012 – Accepted 27 March 2012)

- Cod protein (3 or 6 gram/day for 8 weeks)
- reduced LDL cholesterol level
- improved glucose (sugar) tolerance
- reduced fat storage
- increased muscle mass

Clinical trials

Animal studies





Granit Halstensen



University of Bergen/Haukeland University Hospital

- Section for Gastroenterology
- Section for Cardiology
- Broegelmann Research Laboratory (The Gade Institute)
- Section for Endocrinology
- Department of Chemistry
- Department of Pharmacy
- Department of Clinical Science
- Department of Clinical Medicine



Being fat vs being ill

- Being obese may not cause any health problems ... but it usually does!
- Will we be able to mimic the metabolic changes seen in patients after bariatric surgery before they achieve significant weight loss by using fish or fish proteins?

The Fish Eating Studies 2011-2013

- Fish-1: normoweight, young adults ate 750g/week of chicken, salmon or cod for 4 weeks
- Fish-2: overweight adults ate 750g/week of salmon or cod for 8 weeks
- Fish-3: overweight adults used protein supplements from casein, salmon, cod or herring (2.5g protein/day) for 8 weeks
- RatFish-3: overweight rats were fed fish protein from the same batches as in Fish-3 for 4 weeks
- LE-2011: overweight rats fed high doses of carbohydrates with or without herring peptides for 4 weeks
- Fish-4: overweight adults using protein supplements containing cod press cake meal with or without added stick water (6 g protein/day) for 8 weeks (ongoing trial, ends November 2013)



Why do we study fish protein supplementation?

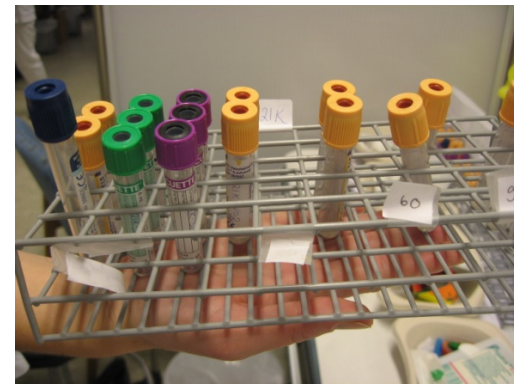
When we do an intervention study with fish intake:

how do we know that we measure the effects of eating fish, and not the effects of not eating something else that is not fish?

Fish proteins taken as supplementation may be a better approach

Design

- Fasting blood samples, saliva, urine and feces (72h) were collected at baseline and at end-point
- Oral glucose tolerance test using a standardised breakfast meal
- 5-day dietary record charts and 7-day registration of physical activity
- Subcutaneous adipose biopsies



Hypotheses (inspired by findings after surgery)

- A high dietary intake of fish or fish in obese proteins will
 - improve glucose tolerance
 - improve serum lipids
 - increase excretion of fats in feces
 - reduce content of bile acids in feces
 - increase the content of omega-3 fatty acids in leukocytes
 - improve the immune function measured as leukocyte functions (phagocytosis, chemotaxis *ex vivo*)
 - improve inflammatory status and reduce oxidative stress



Sarcopenia and sarcobesity

- Age-related loss of muscle mass combined with loss of muscle function or strength
 - affects more than 30% of persons >60 years and more than 50% of persons >80 years
- Sarcopenia is also seen in the physically active
- Higher content of adipose tissue both inter- and intra muscularly, leading to reduced muscle strength and inflammation
- Sarcobesity: when sarcopenia coexist with increased adipose mass, and lipid accumulation inhibits incorporation of amino acids and reduces protein synthesis in skeletal muscle



Interpretation of our findings so far

- It seems that intake of fish or fish proteins may improve the metabolic health of obese/overweight and otherwise healthy adults
 - this may reduce the risk of developing diseases
- Dietary advice for the obese/overweight population should include intake of fish or fish protein
- Our findings regarding improved insulin sensitivity and immune function suggests that also persons with sarcopenia or sarcobesity would benefit from a higher intake of fish or fish protein
 - fish provides an excellent protein source for elderly with problems to chew



Functional food

- The fish industry and the food industry should see the huge potential for using fish protein supplementation for both the obese and the sarcopenic populations
- Also, the industry should embrace the need for smaller sized fish meals
- Small amounts of fish proteins (2.5g /day) may be sufficient to give beneficial health effects
- Fish protein may be added to several products, but preferably not carbohydrate rich meals as carbohydrates may prevent protein synthesis in elderly



Thank you for listening!

