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Dietary Oat Bran and Probiotic Interaction in Polyunsaturated Fatty Acid and Oxylipin Metabolism

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Dietary oat bran and probiotic interaction in polyunsaturated fatty acid and oxylipin metabolism

ISAPP, Singapore 2018

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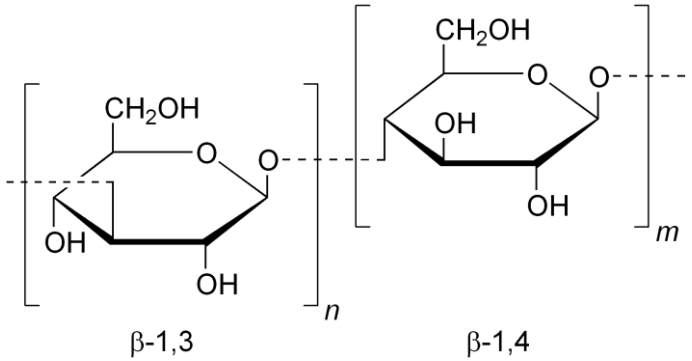
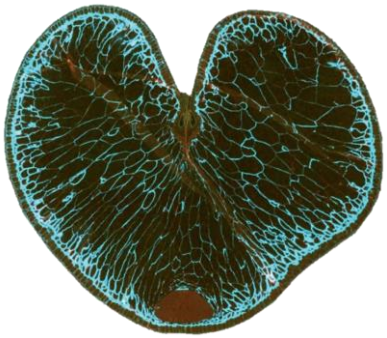
The University of Hong Kong, School of Biological Sciences

Oat bran

- Prebiotic
- 3-8g, 82% water-soluble
- β-glucan
- Linear, branched, degree of polymerization all determine solubility
- Only soluble ones can be fermented
- Fermented by bacterial β-glucosidase in gut
- Selectively proliferate gut bacteria
- PUFA n-6 and n-3
- Phytochemicals (antioxidant)
- Resist host digestion

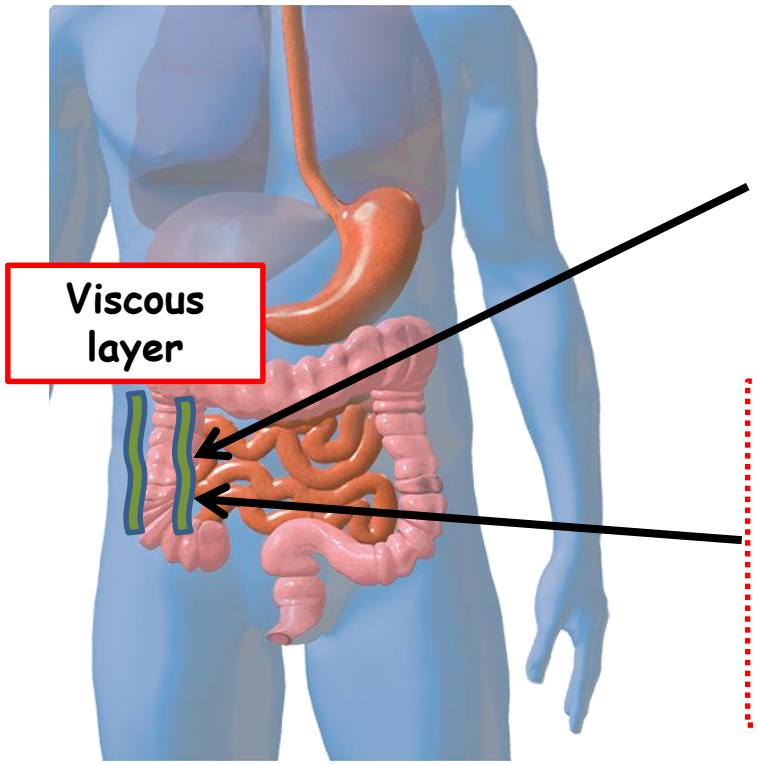




Microscopic picture of the cross section of oat grain, stained with Calcofluor and Acid Fuchsin

Sibakov et al., 2012

Oat β-glucan Mechanisms



Cholesterol Synthesis

- ↓ Cholesterol and bile acid reabsorption
- ↑ Hepatic bile acid synthesis
- ↓ Cholesterol levels

Improves Intestinal Barrier

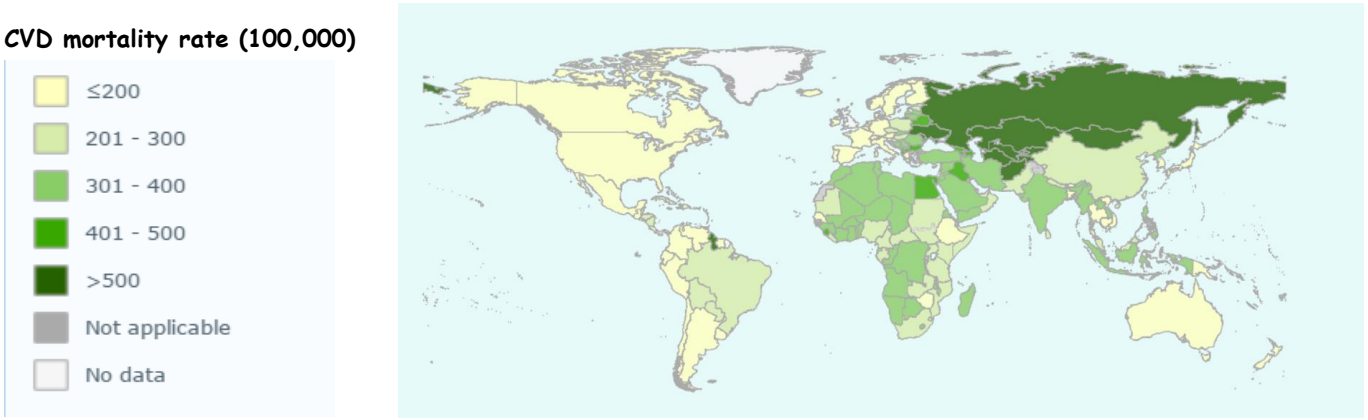
- ↑ Absorption and removal of toxins
- Improve gut barrier junctions
- ↓ Permeability

EFSA, EFSA Journal 2010. 8:1885.
Shen, R.-L., et al., J Agric Food Chem, 2012. 60:11301.

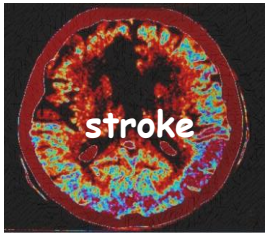
Oat bran and heart disease

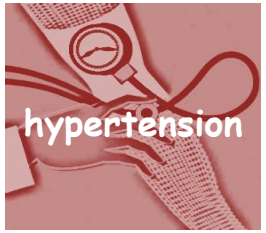
In 2012, CVD was the leading cause of NCD deaths (17.5 million).

*Global Health Observatory , World Health Organisation

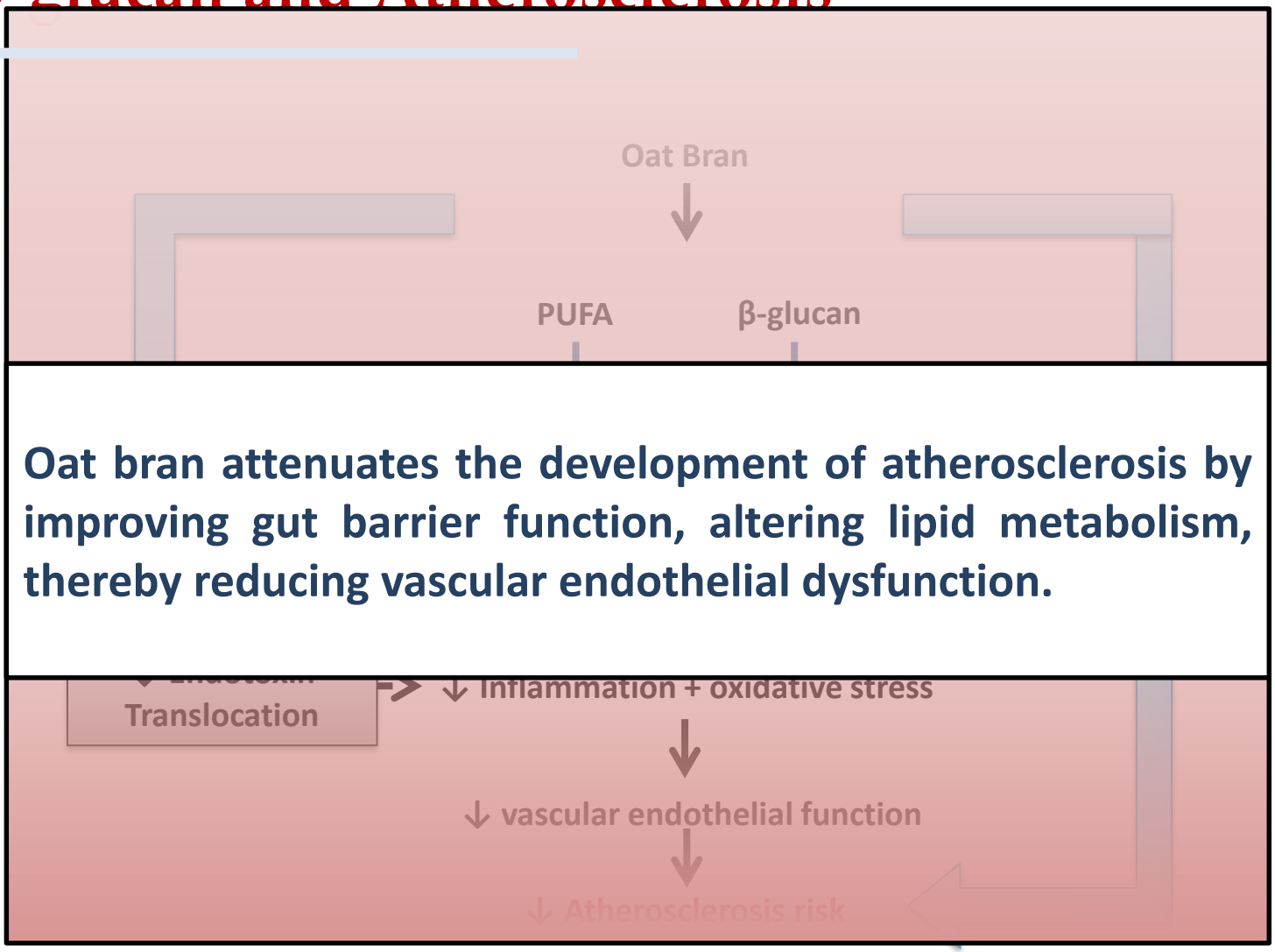


CVDs due to Atherosclerosis

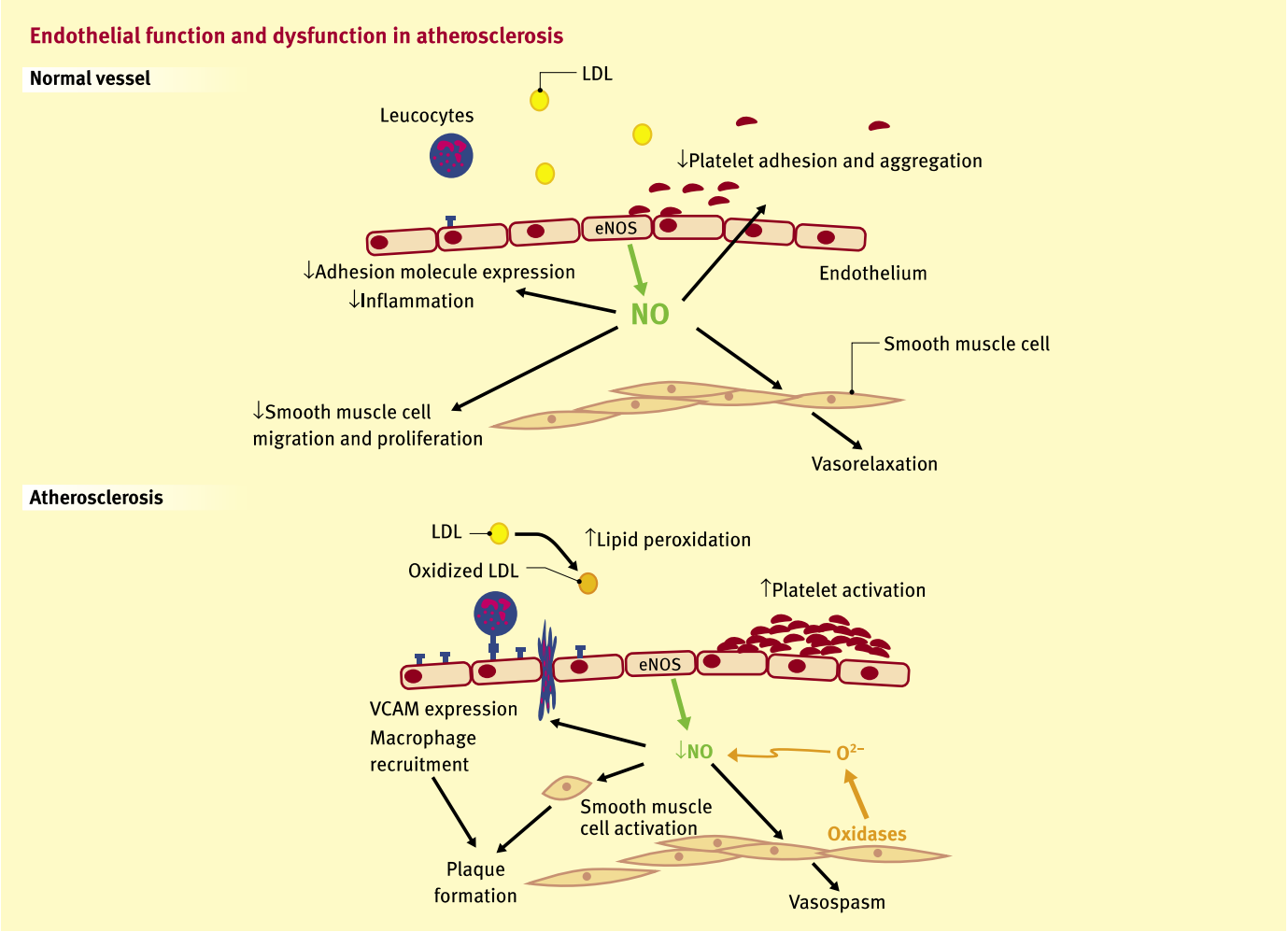




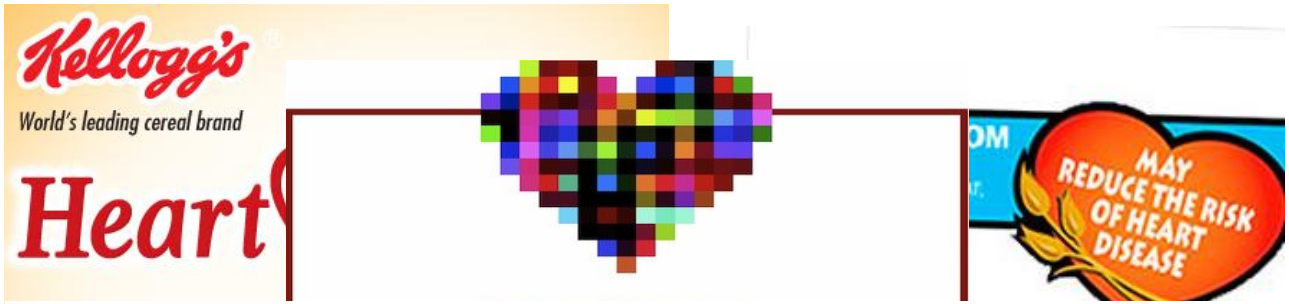
Oat β-glucan and Atherosclerosis



Vascular Endothelial Dysfunction



Channon, Medicine, 2002. 30:54-58.



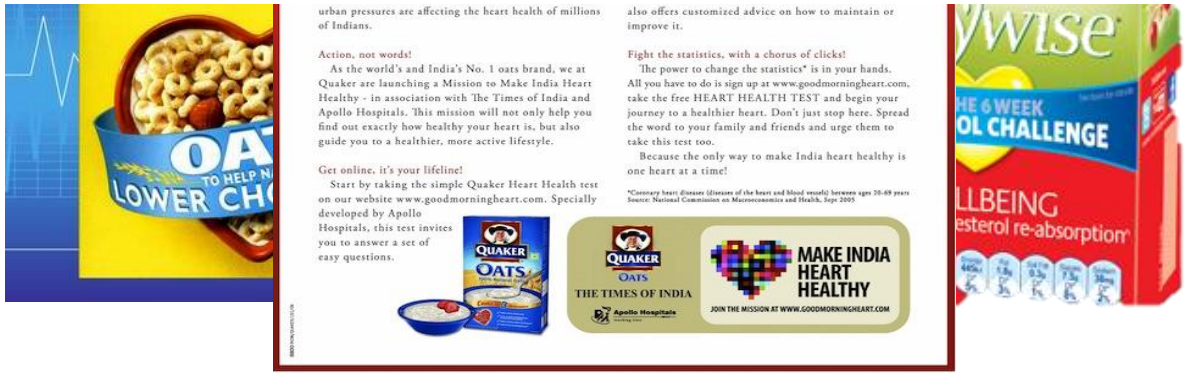
Mol. Nutr. Food Res. 2012, *56*, 1003–1013 DOI 10.1002/mnfr.201100706

REVIEW

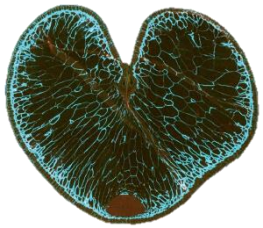
Dietary oats and modulation of atherogenic pathways

Kristina E. Andersson and Per Hellstrand

Department of Experimental Medical Science, Lund University, Lund, Sweden



Oat bran fractionation methods



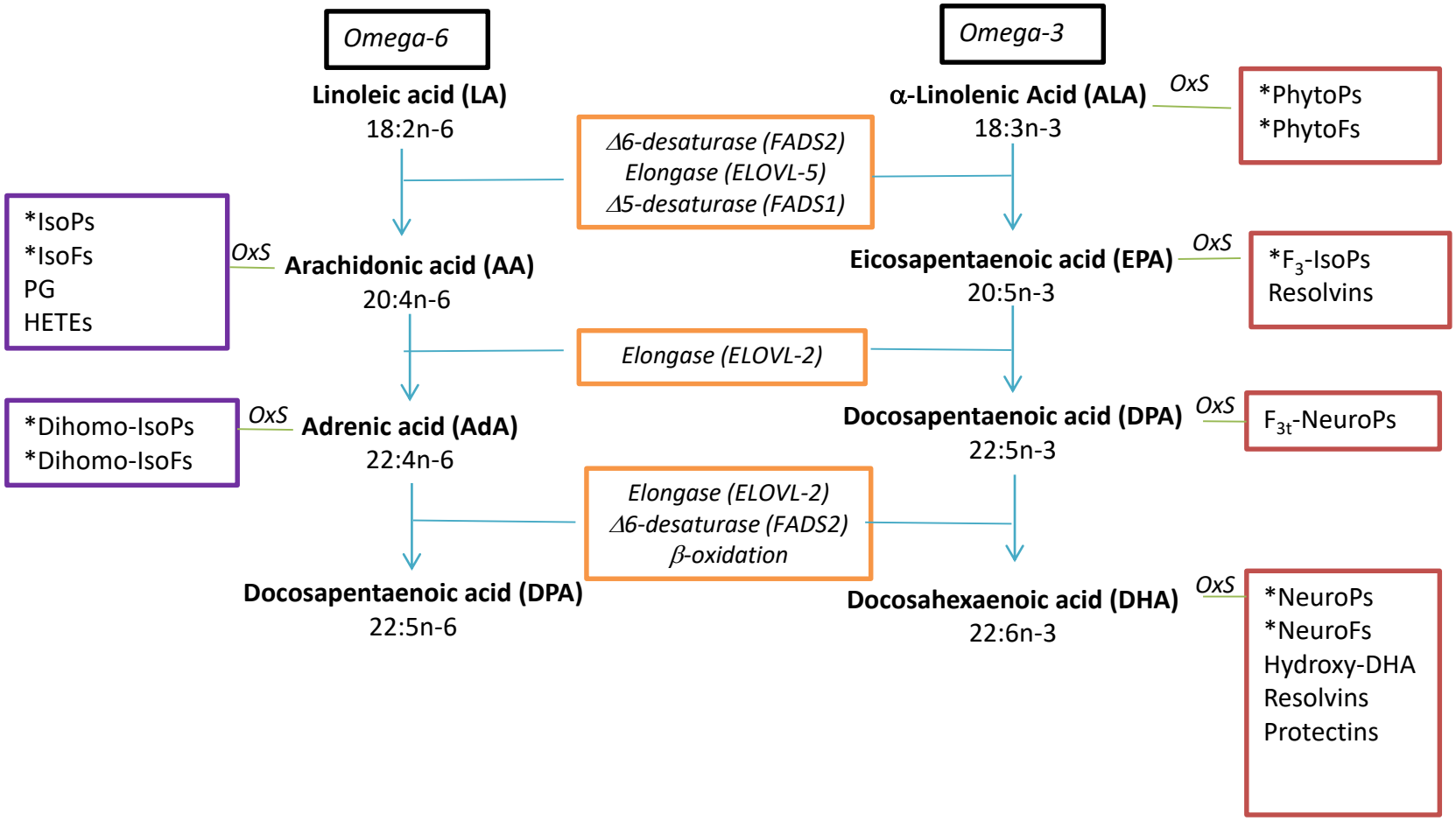
Oat bran

Unrefined Oat Bran

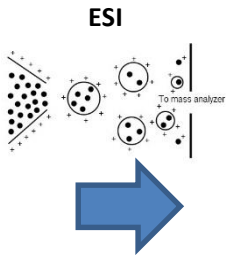
Oat Bran Concentrate

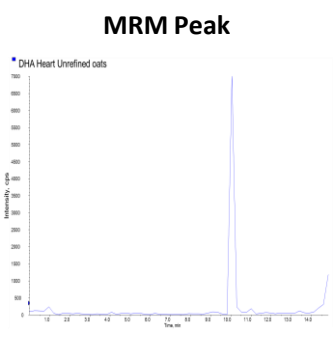
Low MW β-Glucan Concentrate

Oxylipins (lipid mediators) of PUFAs



LC-MS/MS



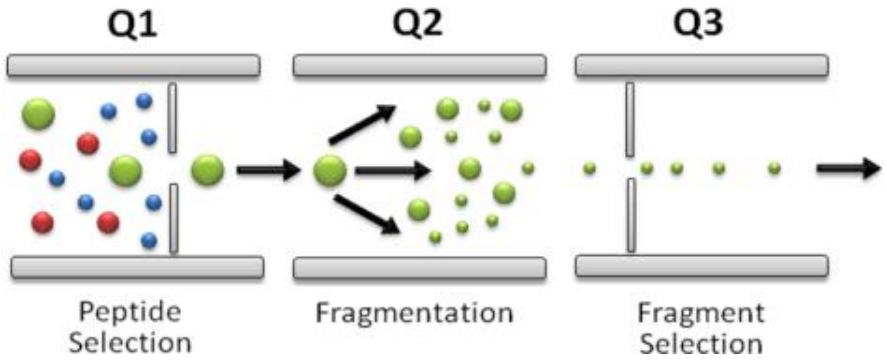


LC Separation

- C18 Column
- 2.6um particle size
- 2.1 x 150 mm
- 10µl sample
- Flow rate 200 µl/min
- ESI

MRM Detection

- Triple Quadrupole
- Linear ion trap capabilities

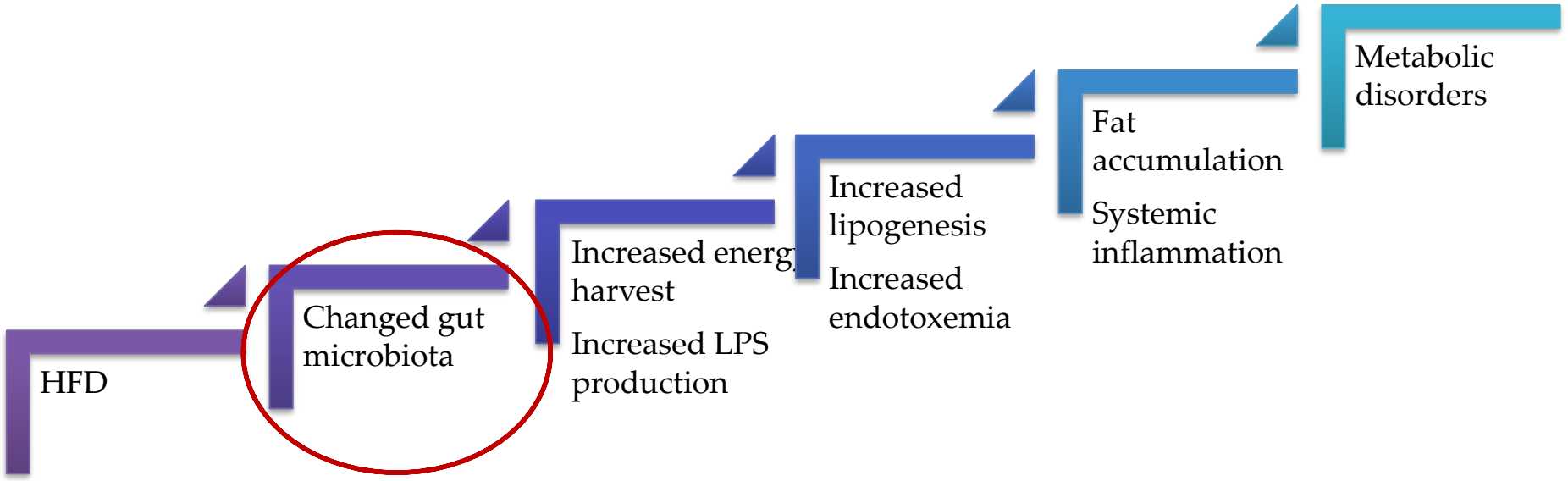


Summary

- Oat bran only reduced plaque and did not improve lipid profile or endothelial function;
- PUFA in oat bran modified PUFA liver and heart;
- Anti-inflammatory lipid mediators are suppressed and pro-inflammatory elevated;
- Gut phylum suggest HFD with oat bran reduced short-fatty acid production.

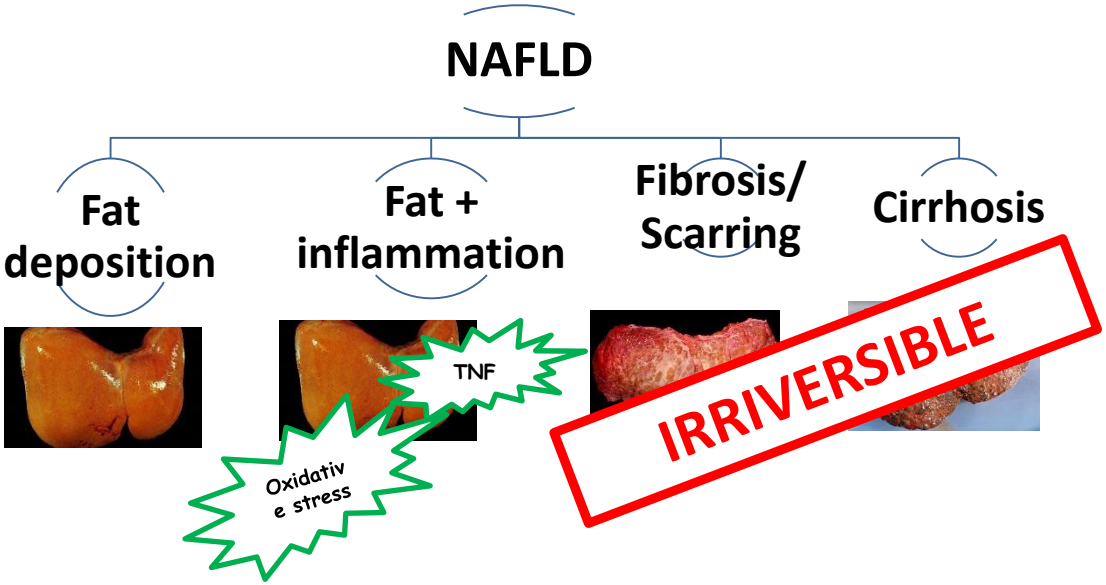
- The fibre in oat bran may help in cholesterol metabolism and not PUFA metabolism.

HFD and Metabolic Disorders



HFD and NAFLD

- Non-alcoholic fatty liver disease (NAFLD) - a range of hepatic complications
- Mainly attributed to metabolic syndrome and obesity



Probiotics

Probiotic Health Benefits	Possible Mechanisms
Immune modulation Immunity ↑ Inflammation ↓	T-cell numbers and activity levels enhancement Promote anti-inflammatory cytokine production
Nutrient value ↑	Vitamin and co-factor production
Cancer risk ↓	Detoxification of carcinogenic metabolites
Atopic allergy symptoms ↓	Suppression of hypersensitivity
Dietary intolerance ↓	Catabolism of dietary ingredients
Gastrointestinal disorder or dysfunction ↓	Not defined
Pathogen burden ↓	Competitive exclusion Direct antagonism

***Lactobacillus Rhamnosus* GG**

- *In vitro* modulation of healthy human immune cells
- *In vivo* modulation of intestinal barrier and immunity in mice exposed to selected mycotoxins
- *In vivo* reduction of tumor growth through immunomodulation and inhibition of angiogenesis

Summary

- Synbiotic diet did not enhance essential PUFA;
- Synbiotic diet reduced lipid mediators related to inflammation;
- Not all anti-inflammatory mediators were elevated by symbiotic diet.

- The two studies indicate probiotic, prebiotic and synbiotic interposition in HFD diets are not favourable in the regulation of PUFA and its mediators.

Acknowledgements

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