

# “Key Scientific Drivers Behind Probiotic and Prebiotic Applications”



International Symposium of the International Scientific Association  
of Probiotics and Prebiotics

June 5-6, 2018, Furama Riverfront Hotel, Singapore

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



**Jetty Chung-Yung LEE**

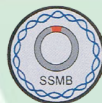
**Hong Kong**

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

*ISAPP, Singapore 2018*

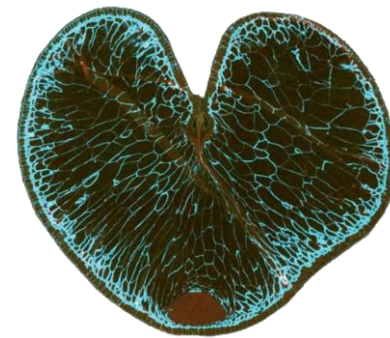
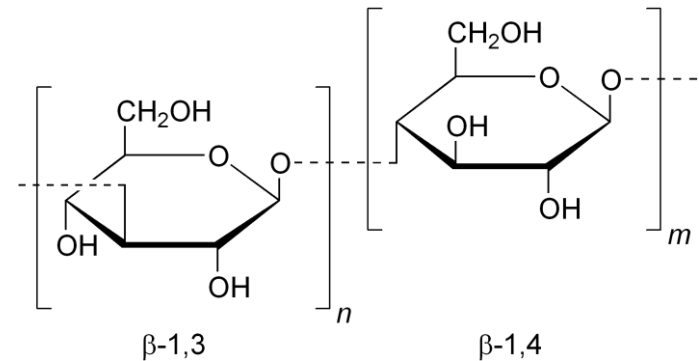


**Jetty Chung-Yung Lee, Ph.D.**

The University of Hong Kong, School of Biological Sciences

# Oat bran

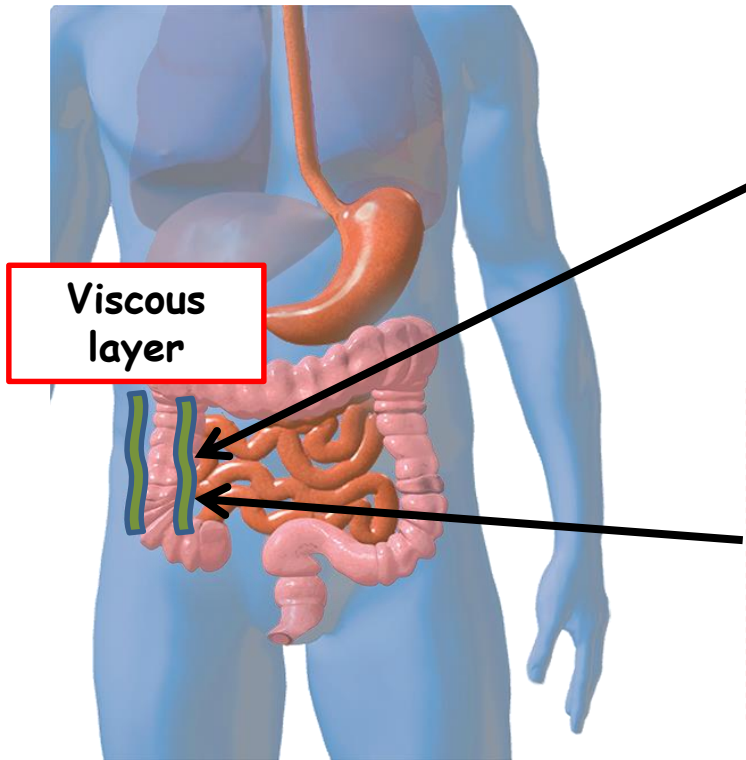
- Prebiotic
- 3-8g, 82% water-soluble
- $\beta$ -glucan
- Linear, branched, degree of polymerization all determine solubility
- Only soluble ones can be fermented
- Fermented by bacterial  $\beta$ -glucosidase in gut
- Selectively proliferate gut bacteria
- PUFA n-6 and n-3
- Phytochemicals (antioxidant)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



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

Sibakov et al., 2012

# Oat $\beta$ -glucan Mechanisms



## Cholesterol Synthesis

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

## Improves Intestinal Barrier

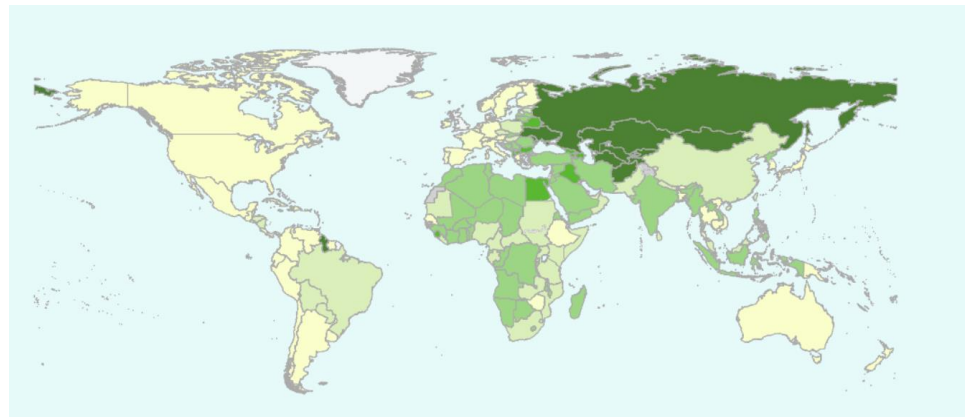
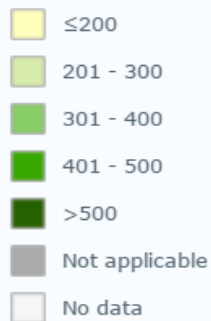
- ↑ Absorption and removal of toxins
- Improve gut barrier junctions
- ↓ Permeability

# Oat bran and heart disease

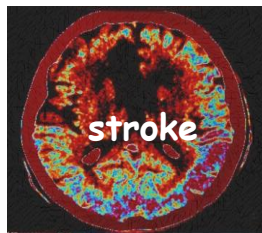
In 2012, CVD was the leading cause of NCD deaths (17.5 million).

\*Global Health Observatory , World Health Organisation

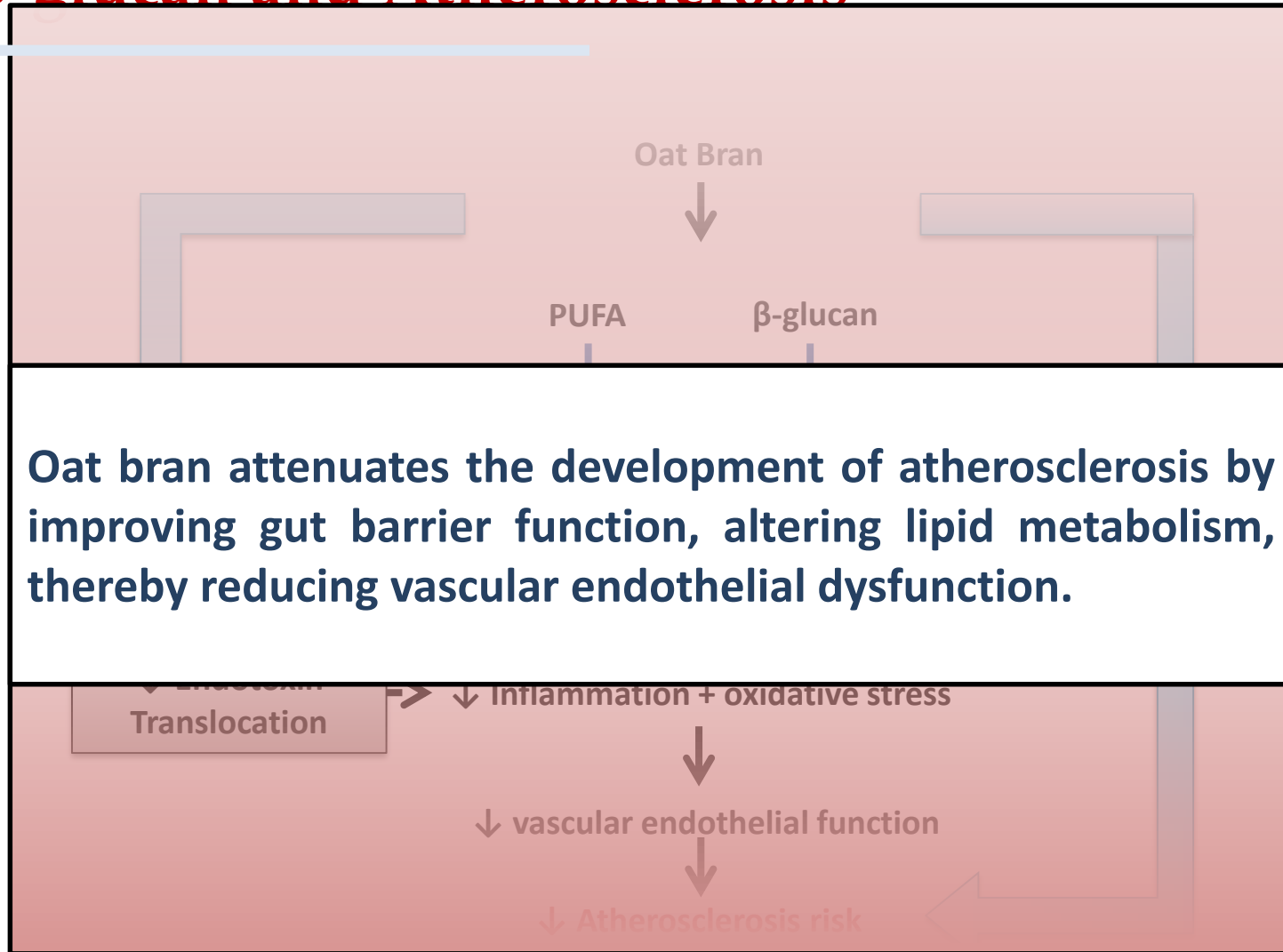
CVD mortality rate (100,000)



## CVDs due to Atherosclerosis



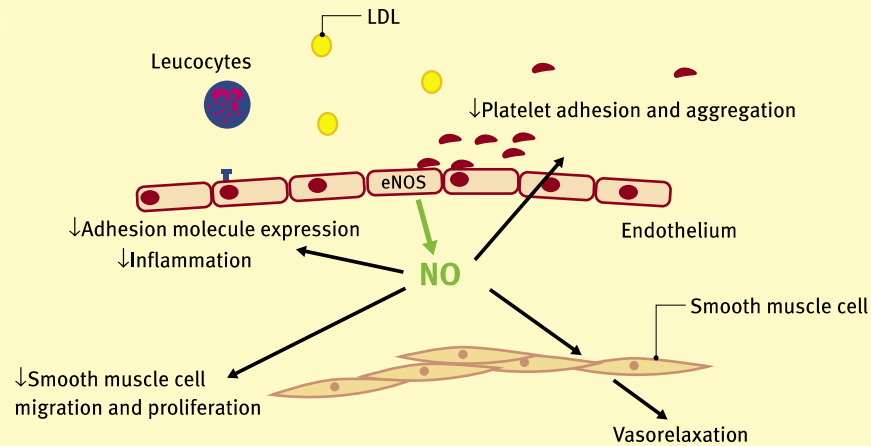
# Oat $\beta$ -glucan and Atherosclerosis



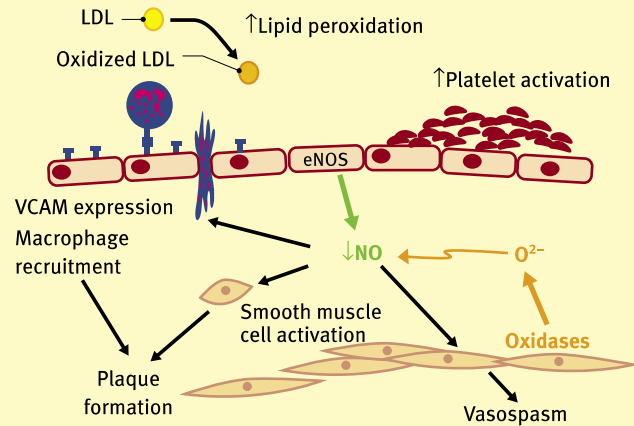
# Vascular Endothelial Dysfunction

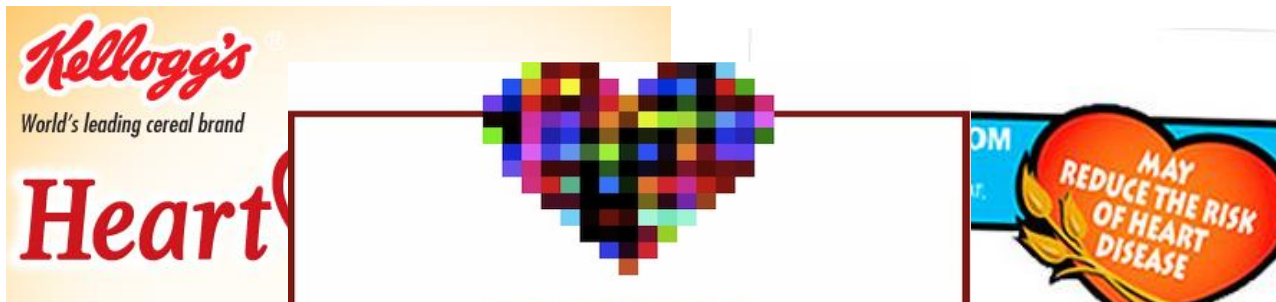
## Endothelial function and dysfunction in atherosclerosis

### Normal vessel



### Atherosclerosis





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

urban pressures are affecting the heart health of millions of Indians.

Action, not words!

As the world's and India's No. 1 oats brand, we at Quaker are launching a Mission to Make India Heart Healthy - in association with The Times of India and Apollo Hospitals. This mission will not only help you find out exactly how healthy your heart is, but also guide you to a healthier, more active lifestyle.

Get online, it's your lifeline!

Start by taking the simple Quaker Heart Health test on our website [www.goodmorningheart.com](http://www.goodmorningheart.com). Specially developed by Apollo Hospitals, this test invites you to answer a set of easy questions.

also offers customized advice on how to maintain or improve it.

Fight the statistics, with a chorus of clicks!

The power to change the statistics\* is in your hands. All you have to do is sign up at [www.goodmorningheart.com](http://www.goodmorningheart.com), take the free HEART HEALTH TEST and begin your journey to a healthier heart. Don't just stop here. Spread the word to your family and friends and urge them to take this test too.

Because the only way to make India heart healthy is one heart at a time!

\*Coronary heart disease (disease of the heart and blood vessels) between ages 20-69 years  
Source: National Commission on Macroeconomic and Health, Sept 2005

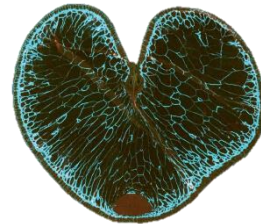
QUAKER OATS THE TIMES OF INDIA Apollo Hospitals

MAKE INDIA HEART HEALTHY JOIN THE MISSION AT [WWW.GOODMORNINGHEART.COM](http://WWW.GOODMORNINGHEART.COM)

wise THE 6 WEEK CHOLEsterol CHALLENGE ALL BEING cholesterol re-absorption



# Oat bran fractionation methods



Oat bran



Unrefined Oat Bran

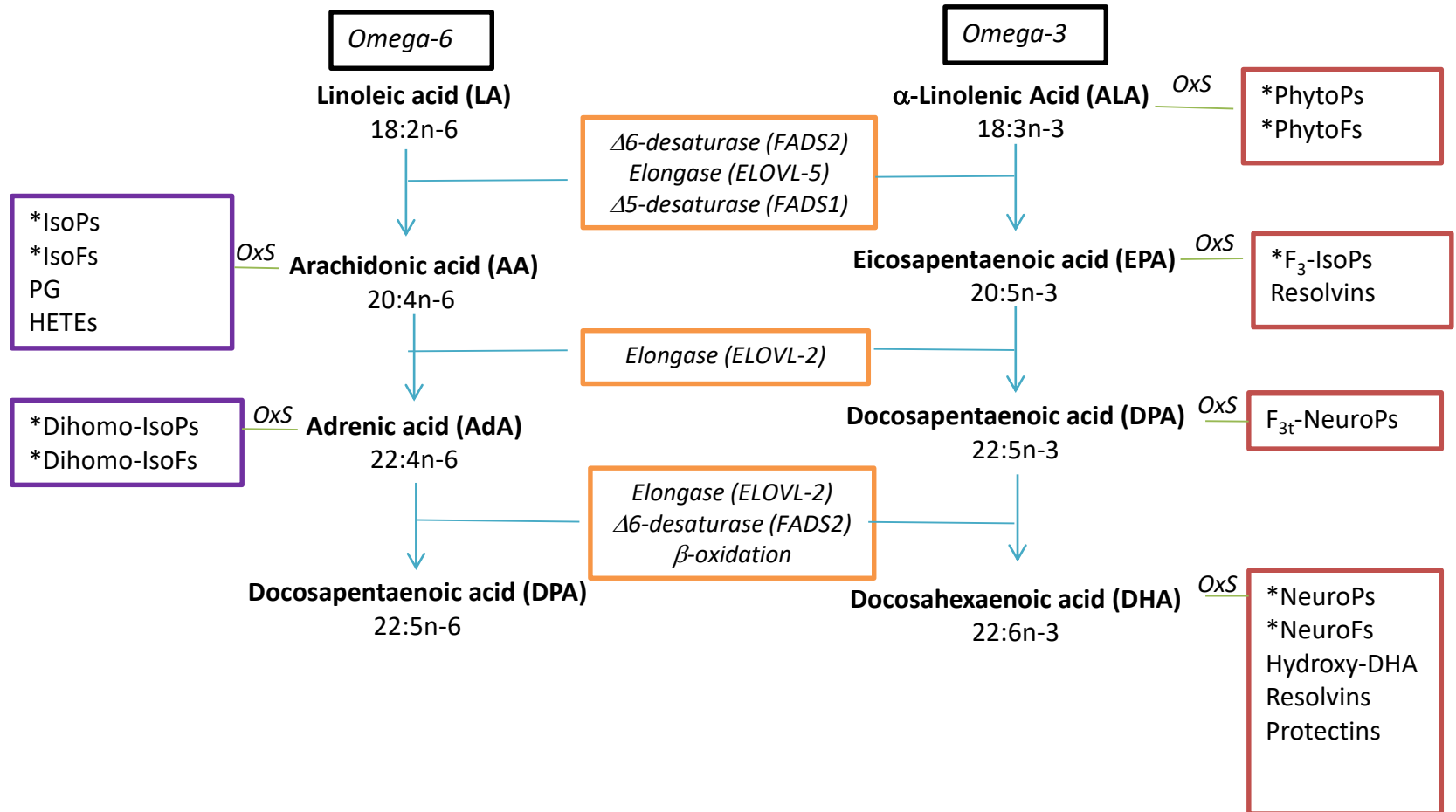


Oat Bran Concentrate



Low MW  $\beta$ -Glucan Concentrate

# Oxylipins (lipid mediators) of PUFAs



# LC-MS/MS

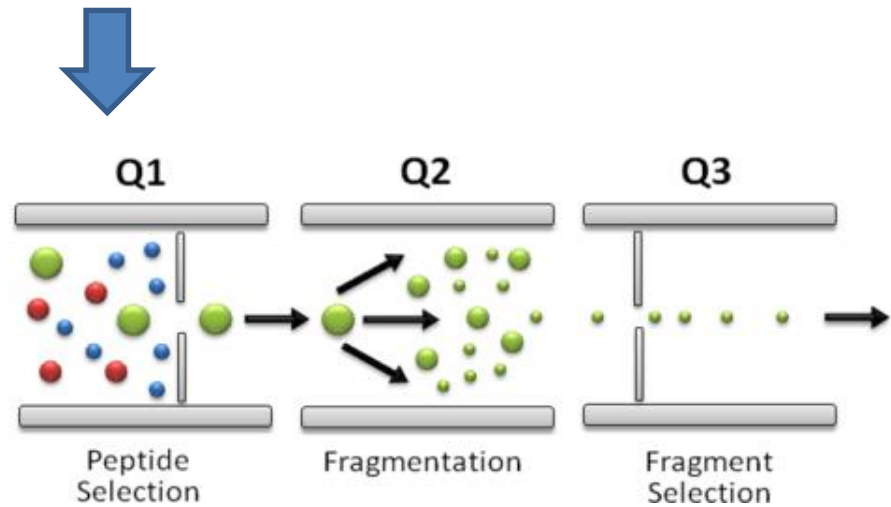


## LC Separation

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

## MRM Detection

- Triple Quadrupole
- Linear ion trap capabilities

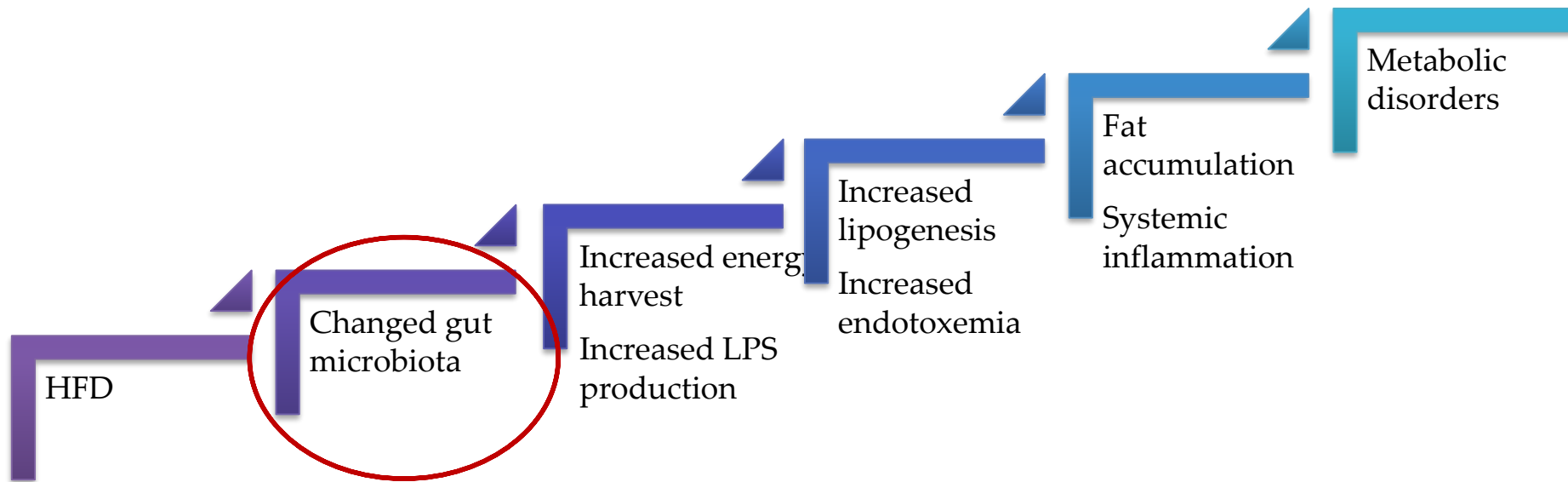


# Summary

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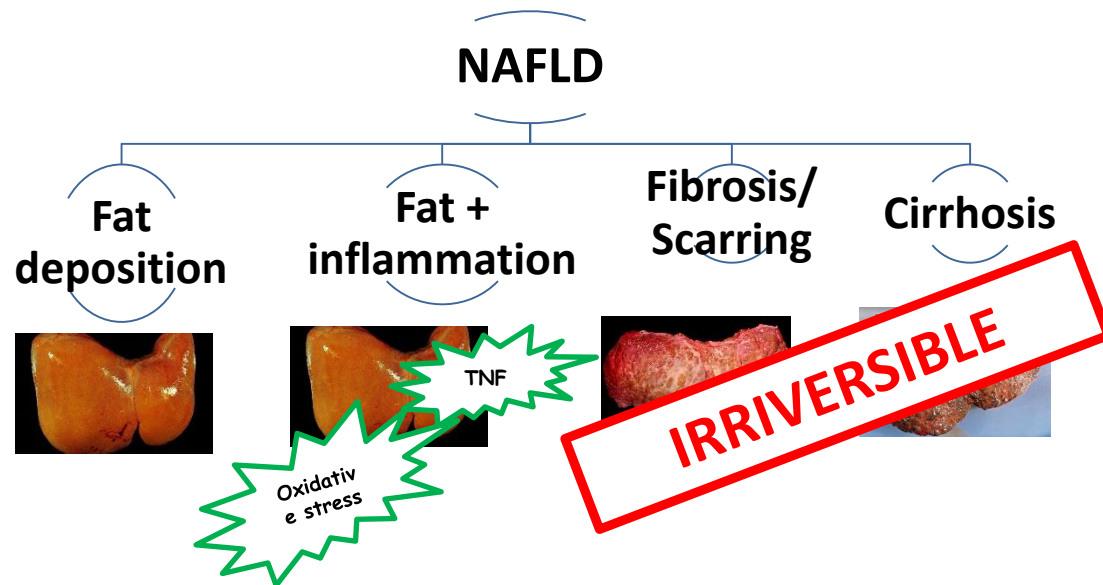
- Oat bran only reduced plaque and did not improve lipid profile or endothelial function;
- PUFA in oat bran modified PUFA liver and heart;
- Anti-inflammatory lipid mediators are suppressed and pro-inflammatory elevated;
- Gut phylum suggest HFD with oat bran reduced short-fatty acid production.
  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

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- 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.
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- 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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