Personalized Nutrition and Health
23rd of November, Food Matters Live, London

Nard Clabbers
Senior Business Developer Personalized Nutrition and Health
TNO Healthy Living
Dutch Applied Research and Technology Organisation
Independent, not for profit
Founded by law (1932)
> 2600 employees
Presentation outline

• Three little pigs

• What is health?

• Personalized nutrition 2.0

• Research and real life examples!

• Conclusions
Three little pigs

1: Both quantity and quality of diet is relevant

2: Fenotypes can differ, even with identical genotypes
A definition of health

• ‘Ability to adapt’
  – Capacity to adapt to live’s many challenges

• ‘Resilience’

• ‘Flexibility’

M. Huber, BMJ 2011
Physiological processes involved in phenotypic flexibility

Kidney
- (Re)absorption
- Urea cycle

Adipose tissue
- Lipolysis & lipotoxicity
- Adipose insulin sensitivity
- Expandability
- Lipokine & adipokine production
- Macrophage infiltration

Vasculature
- Blood pressure regulation
- Endothelial integrity & flexibility

Gut
- Host-microbe interaction
- Absorption
- Intestinal integrity, barrier function
- Gut hormone production
- Gut-mediated inflammation control
- Chylomicron production

Brain
- Endocrine responses
- Secondary messengers
- HPA axis
- Neurotransmitters & precursors

Pancreas
- β-cell function
- α-cell function

Liver
- Core metabolism
- Lipoprotein metabolism
- Bile production
- Hepatic tissue injury control
- Fibrosis & inflammation
- Hepatic insulin sensitivity

Muscle
- Protein metabolism
- Muscle tissue injury control
- Muscle insulin sensitivity

Systemic stress response
- Systemic insulin sensitivity
- Oxidative stress
- Chronic low-grade inflammation
- Adaptation carb/lipid switch
- ER stress

Genes Nutr (2015), 10:13
FROM HEAD TO TOE WEARABLE TECHNOLOGY

SHIRT
Conductive thread means a computer is literally built into the fabric of the shirt, providing the processing power for all the other wearable gadgets.

WRISTBAND
A sensor that tracks movement to determine the number of steps taken throughout the day – 10,000 is ideal – and how much sleep the wearer gets at night.

HAND
Embedded under the skin is a chip containing medical records, passport data and credit records. Information is transferred by waving the hand over a suitable scanner.

TROUSERS
Also made with conductive thread, the trousers take the energy generated by movement and use it to power the other gadgets.

SHOES
GPS chip provides directions using LED lights in each shoe: the left shoe indicates direction, while the right shows distance.

GLASSES
Overlays navigation directions and information about points of interest directly on to the wearer’s field of vision.

WRISTWATCH
Vibrates when a message arrives and displays it on the watch face. Tells the time too.

What’s that (tech) you’re wearing?

Head
- Smart Clothing
- Smart Hair
- Smart Glasses
- Smart Sunscreen

Upper Body
- Smart Bra
- Smart Undies
- Smart Lingerie
- Smart Sleepwear

Wrist
- Google Glass
- LG VR Headset
- Samsung Galaxy Gear
- Apple Watch

What’s that (tech) you’re wearing?

What’s that (tech) you’re wearing?

Physical

Mental/emotional

Behavioral

Cognitive

Gut

Food intake!
Personalized Nutrition ‘2.0’

• Fenotype, ‘sociotype’, genotype, environment, culture, personality, food intake,... everything!

• Data driven
  – Measurements (DIY) of day by day changes
  – Bio-psycho-social aspects of health
    • DNA: sure, also

• PN 2.0 = Empowerment
Pilot study:
Personalised advice for healthy muscles

Screening
- Health survey
- Sedentary behaviour

Baseline measures
At home / at institute

n=60
wk 1-2

Intervention:
- Feedback on muscle health and related behaviour
- Advice on diet and physical activity with personalised content and communicated in personalised form
  wk 5, 8 & 11

Monitoring measures at home:
- Wk 5-13: physical activity
- Wk 7, 10 & 13: food diary
- Wk 5, 8 & 11: compliance & socio-psychological questionnaire

Control:
- Feedback on muscle health and related behaviour
- Generic advice on diet and physical activity
  wk 5, 9 & 13

Intervention period: wk 5-13

End measures
At home / at institute

wk 14-15
DIY tools for muscle health

**Questionnaires**
- Motivation
- Energy
- Resilience

**Instruments**
- Waist, arm & thigh circumference
- Total cholesterol
- HDL & LDL
- Triglycerides
- Handgrip strength

**Samples for lab**
- Fasting & Postprandial glucose
- Fasting & Postprandial C-peptide
- Fasting & Postprandial amino acids
- Fasting fatty acids

**DIY tools for muscle health**
- DIY tools for muscle health
- Genetic variation
  - ACE, TCF7L2, FTO, FADS1, GDF5, VDR

**Short Physical Performance Battery**
- Chair stand
- Balance
- Speed
Individual feedback on health

Appendix A: Beslisboom voor Metabole Gezondheid (MS = Metabolic Syndrome)

Muscle
Wellbeing

Groep
- Optimal (blue)
- Reduced (yellow)
- You (black)

BMI
- < 30
  - Waist Circumference
    - Male < 94
      - Female < 80
      - Low - normal
    - High
  - Triglycerides
    - < 150 mg/dL
      - Normal
    - ≥ 150 mg/dL
      - High
  - HDL
    - Male > 1.03
      - Female ≤ 1.28
      - Normal
    - Male ≤ 1.03
      - Female > 1.28
      - Low

Blood pressure
- Systolic BP < 130 mmHg
  - Diastolic BP < 85 mmHg
  - Normal
- Systolic BP ≥ 130 mmHg
  - Normal

Fasting glucose
- < 5.6 mmol/L
  - Normal
- ≥ 5.6 mmol/L
  - MS

pnh
Personalised Nutrition & Health
TNO/WUR ‘Personalised Nutrition and Health’ Research Program

For a society in which each individual can and will make a motivated and sustained choice for a healthy diet.
Prepare
I prepare and cook food to my liking

Eat & Drink
I eat healthy tasty food tailored to my needs
3D PRINTED PERSONALIZED FOOD
**Big data & modeling**

My data and other relevant information is securely processed to develop in-depth insights.
Targeted & personal advice
I choose when and how to receive science based advice based on my nutritional and lifestyle needs

Big data & modeling
My data and other relevant information is securely processed to develop in-depth insights
Buy
I find products and services that fit my needs during each and every moment

Prepare
I prepare and cook food to my liking

Empowerment
I am empowered to adapt my lifestyle to feel good
Company example: Day Two

Enjoy eating better and feeling better based on your microbiome.

Personalized nutrition based on your gut microbiome and the way your body processes food.

Pre-order now
Company example: Habit

NUTRITION JUST GOT PERSONAL

When your body's unique biology gets just the right foods in the right amounts, something amazing happens – you thrive.
Conclusions

Two converging megatrends

- Health and wellness
- Digital and tech revolution make PN 2.0 possible

Holistic, consumer centered approach is needed

- Towards health
- Towards science
- Towards business cases
END
TNO Stand RP83