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Koolhydraten, insulinegevoeligheid, Spieren en gezondheid

Ellen E Blaak
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Department of Human Biology, Maastricht University

Voeding NL congres, dinsdag 10 maart, jaarbeurs Utrecht

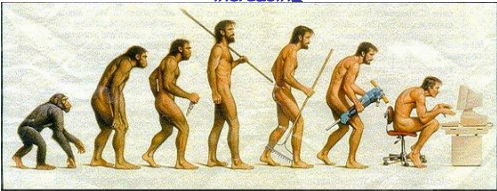
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Overzicht presentatie

- Inleiding insuline gevoeligheid en glucose homeostase
- Voedingsadviezen voor specifieke subgroepen
 - Type 2 diabetes mellitus
- Personalised nutrition

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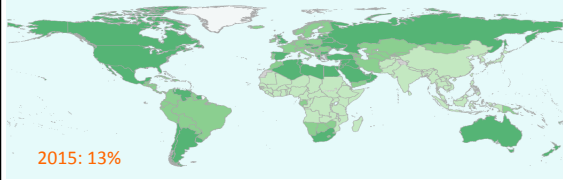
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The prevalence of obesity and type 2 diabetes mellitus is increasing



Somewhere, something went terribly wrong

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Worldwide obesity nearly tripled since 1975

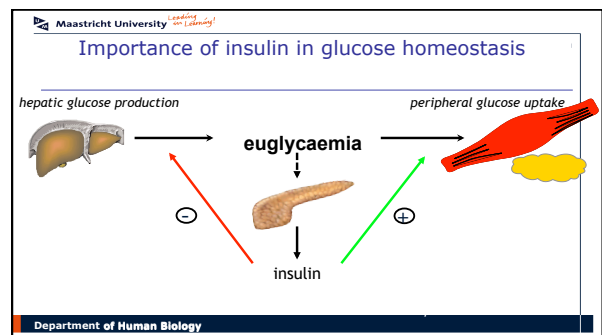
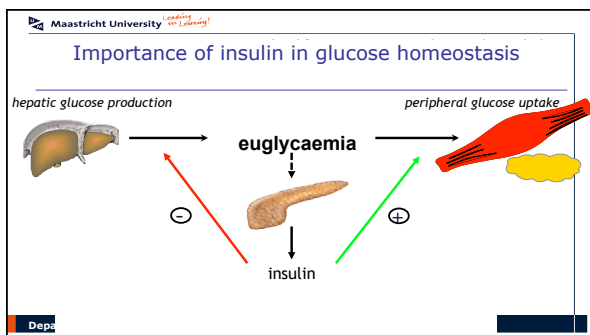
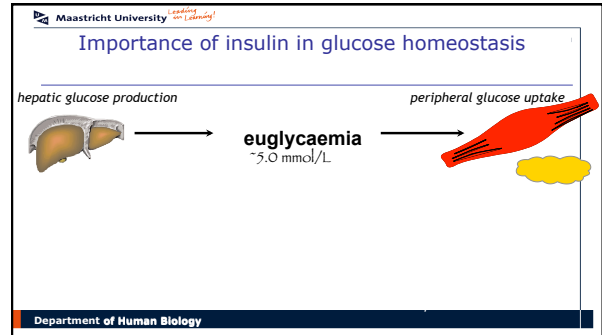
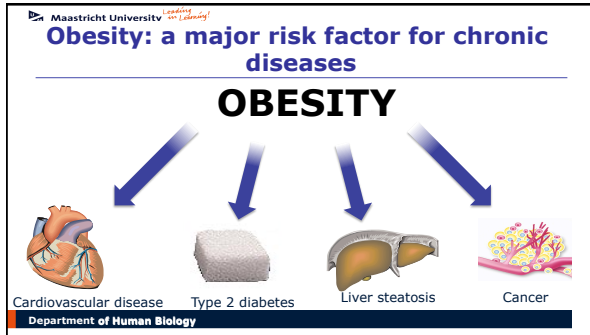


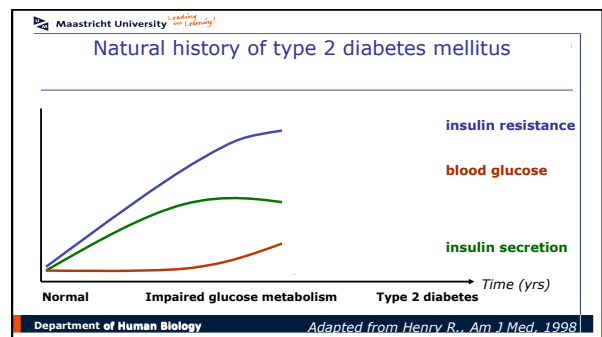
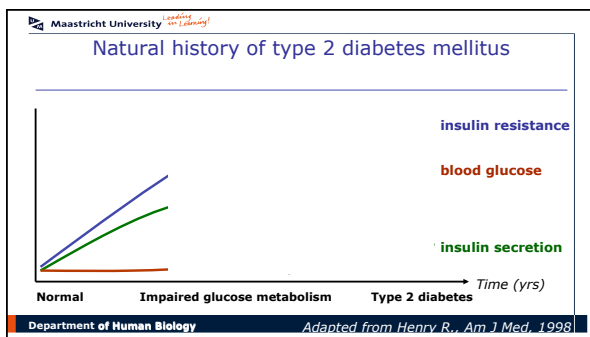
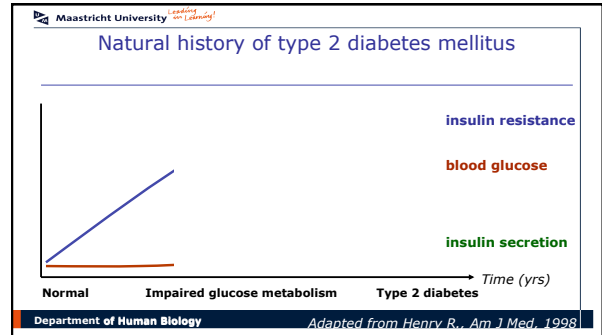
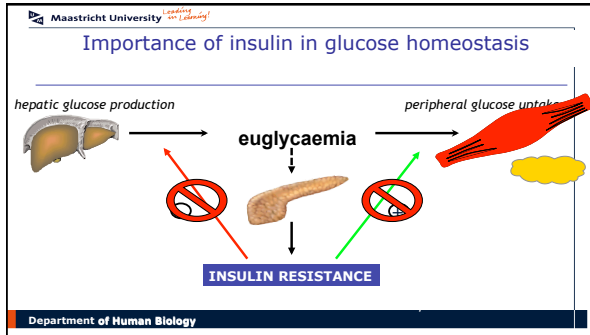
2015: 13%

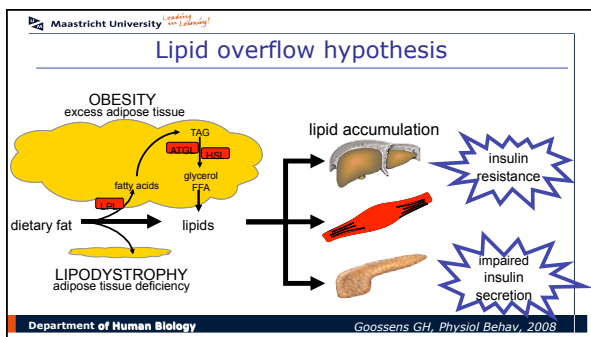
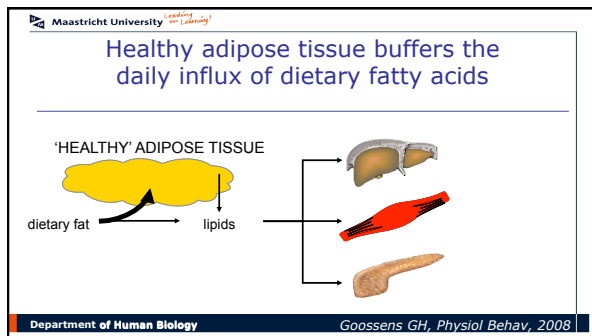
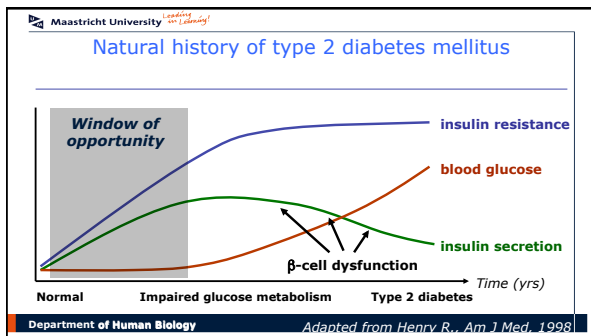
www.who.int

Worldwide (≥ 18 yr), 2016: 39% of adults (1.9 billion) is overweight, of which 13% (>650 million) is obese.

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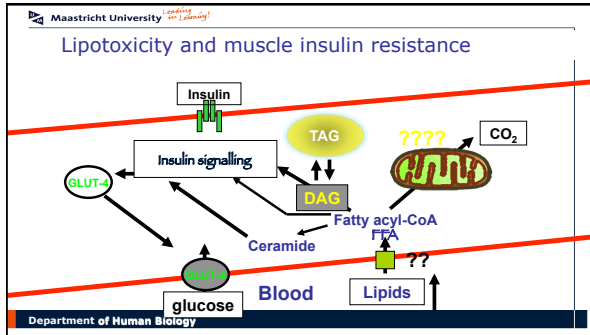




Lipid overflow and metabolic inflexibility in the pathogenesis of insulin resistance

- ectopic lipid accumulation strongly linked to insulin resistance
- tissue specific ↑ and ↓ in lipid content cause corresponding changes in tissue specific insulin action

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WHO criteria for impaired glucose metabolism

- Diabetes: Fasting plasma glucose ≥ 7.0 mM and/or 2-h glucose ≥ 11.1 mM
- Impaired glucose tolerance: Fasting plasma glucose < 7.0 mM and/or 2-h glucose ≥ 7.8 mM
- Impaired fasting glucose: Fasting plasma glucose ≥ 6.1 and (if measured) 2hr glucose < 7.8

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Genes, lifestyle and diabetes: the Pima Indians

- traditional' lifestyle: NW Mexico
- 'affluent' lifestyle: Arizona, USA
- Matched for age and gender:
- BMI 24.9 kg/m² vs. 33.4 kg/m²
- Diabetes 8.5 % vs. 41%

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Recommendations: EASD Nutrition Study Group

(Evidence-based nutritional approaches to the treatment & prevention of diabetes mellitus, Mann et al. 2014 Nut Metab Cardiovasc Dis (2004) 14: 373-394)

Carbohydrate	<ul style="list-style-type: none"> • Total CHO 45 – 60% TE influenced by metabolic characteristics • Vegetables, fruits, wholegrains, legumes preferred
Fibre	<ul style="list-style-type: none"> • Foods naturally rich in fibre • >40g/day (20g/1000kcal), half soluble, lesser amounts beneficial
GI	<ul style="list-style-type: none"> • CHO rich low GI foods good choices provided other attributes ok
Free sugars	<ul style="list-style-type: none"> • If desired blood glucose levels ok, up to 50g/day incorporated into diet • <10%TE, less if overweight, avoid SSBs

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ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD

The Task Force on diabetes, pre-diabetes, and cardiovascular diseases of the European Society of Cardiology (ESC) and developed in collaboration with the European Association for the Study of Diabetes (EASD).

Department of Human Biology European Heart Journal, 2013

ESC (2013)

❖ **Macronutrients and dietary fibre as per DNSG (2004)**

- ❖ Mediterranean type diet for those preferring a higher fat intake
- ❖ Dietary fibre >40g/day
- ❖ Vegetables, legumes, fruits & wholegrain cereals should be part of diet

❖ There is no justification for the recommendation of very low carbohydrate diets in DM

❖ Coffee drinking: >4 cups/day associated with a lower risk of CVD in people with T2DM, but not boiled coffee without filtering

❖ Recommendations relating to fat & fibre: **Level A**

❖ Any diet with reduced energy intake can be recommended for lowering excess body weight in DM: **Level B**

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NDF Voedingsrichtlijn diabetes 2015

Evidence-based Voedingsrichtlijn

Department of Human Biology **ndf** nederlandse diabetes federatie

The Netherlands:

- The quality of the fats & carbohydrates is more important than amount of macronutrients
- The diet should be:
 - ✓ Rich in wholegrain products, fruits, vegetables, legumes & nuts
 - ✓ Moderate alcohol consumption
 - ✓ Low in refined cereal products, red or processed meat & a low intake of sugar-containing drinks
- Various dietary patterns are suitable for prevention and management of diabetes, e.g. Mediterranean, low GI, vegetarian, moderate carbohydrate-restricted

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The Netherlands:

- ✓ Carbohydrate restriction has a beneficial effect on HbA1c, insulin levels & glucose tolerance
- ✓ Quantity & quality of carbohydrates are important, in particular, limiting refined carbohydrate sources and products with free sugars.
- ✓ A low carbohydrate diet includes a maximum of 40% En.
- ✓ (Very) low carbohydrate diets in type 2 diabetes seem effective and safe. Long-term studies are scarce and dropout rate for long-term studies (>2years) is high so the level of evidence is lower in the long term.
- ✓ These diets require medical supervision

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Diabetes Care Volume 42, May 2019 731

Nutrition Therapy for Adults With Diabetes or Prediabetes

Alison B. Evert,¹ Michelle Dennison,² Christopher D. Gardner,³ W. Timothy Garavito,^{4,5} Eric Abel Kivimäki,⁶

Low-carbohydrate eating patterns, especially very low-carbohydrate (VLC) eating patterns, have been shown to reduce A1C and the need for antihyperglycemic medications.

....are among the most studied eating patterns of type 2 diabetes.

...from the current evidence, this eating pattern does not appear to increase overall cardiovascular risk, but long term studies with clinical event outcomes are needed.

less comorbidity, and socioeconomic settings in which they live. Research provides clarity on many food choices and eating patterns that can help people achieve health

Alison B. Evert, University of Alabama at Birmingham, Birmingham, AL
Birmingham Veterans Affairs Medical Center.


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Diet Doctor Low carb & keto Recipes Health Video News

American Diabetes Association endorses low-carb diet as option

April 23 by Ashley Hays, PhD, RD | [View full article](#) | [Share this article](#) | [Download this article](#)




A recent consensus statement from the American Diabetes Association (ADA) recommends that people with diabetes be offered individualized medical nutrition therapy, rather than be given the "one-size-fits-all" advice to count carbohydrates and restrict calories. Included in options that should be offered to patients are low-carbohydrate diets.

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Are low carbohydrate diets more beneficial than higher carbohydrate diets in adults with type 2 diabetes?



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Carbohydrates and carbohydrates...




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WILEY

REVIEW ARTICLE

Carbohydrate quantity in the dietary management of type 2 diabetes: A systematic review and meta-analysis

Henny-Kristine Korsmo-Haugen MSc¹ | Kjetil G. Brurberg PhD² | Jim Mann DM³ | Anne-Marie Aas PhD⁴

Abstract: This systematic review and meta-analysis (registration number: CRD42013005823) compares the effects of low carbohydrate diets (LCD) on body weight, glycemic control, lipid profile and blood pressure with the effects of higher carbohydrate diets (HCD) in adults with type 2 diabetes.

Methods: MEDLINE, EMBASE, CENTRAL, CINAHL, Food Science Source and SwedMed databases were systematically searched to identify randomised controlled trials (duration > 3 months) investigating the effects of an LCD compared to an HCD in the management of type 2 diabetes. Data were extracted and pooled using a random effects model and were expressed as mean differences and risk ratios. Subgroup analyses were undertaken to examine the effects of duration of intervention, extent of carbohydrate restriction and risk of bias. The certainty of evidence was assessed using GRADE.

Results: Of the 5589 studies identified, 23, including 2178 participants, met inclusion criteria. Reductions were slightly greater with LCDs than with HCDs for HbA1c (-1.10 mmol/mol; CI: -1.9, -0.3) ($P < 0.001$), CG (0.37, -0.02) and for triglycerides (-0.13 mmol/L; CI: -0.24, -0.02). Changes in weight, HDL and LDL-cholesterol, total cholesterol and blood pressure did not differ significantly between groups. Subgroup analyses suggested that the difference in HbA1c was evident only in studies with a duration of < 6 months and with a high risk of bias.

Conclusions: The proportion of daily energy provided by carbohydrates is not an important determinant of response to dietary management, especially when considering longer term trials. A range of dietary systems, including those traditional in Mediterranean countries, seems suitable for translating nutritional recommendations for individuals with diabetes into practical advice.

The authors performed this systematic review as part of their usual professional activity and received no particular funding for the work.

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Included studies

- Included: 23 RCTs, 4 with cross-over design
- Total participant: 2178
- Study duration: 3 m - ca 3 y
- CHO content LCD: 5 - 40 E%
- CHO content comparator: 42 - 65 E%
- Energy reduced diets
 - 6 of the LCD
 - 10 of the comparator diets

1180 records identified through database searching in 2013

399 records identified through database searching in 2016

10 additional records identified through other sources

1589 records screened by title and abstract

1402 records excluded after screening by title and abstract

187 retrieved and screened by full text

164 articles excluded after screening by full-text

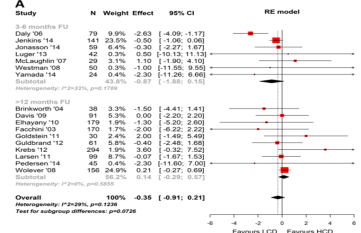
23 studies included in qualitative synthesis

29 studies included in quantitative synthesis (meta-analysis)

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Body weight: Low-carb diet vs comparator

Study	N	Weight	Effect	95% CI
2-6 months FU				
Daly 06	79	9.9%	-2.63	[-4.09; -1.17]
Jenkins 14	141	23.5%	-0.50	[-1.06; 0.06]
Jonsson 14	59	6.4%	-0.30	[-0.77; 0.17]
Luger 13	42	0.3%	0.50	[-0.13; 1.13]
McLaughlin 07	23	2.3%	1.10	[-1.50; 4.10]
Vidalman 08	56	0.4%	-1.03	[-1.38; -0.68]
Yarnall 14	24	0.4%	-2.30	[-1.26; -0.66]
Heterogeneity: I²=32%; p=0.759				
7-12 months FU				
Birkworth 04	38	3.3%	-1.50	[-4.41; 1.41]
Davis 09	81	0.3%	0.00	[-2.20; 2.20]
Elshorbagy 10	178	1.9%	-1.30	[-5.20; 2.60]
Fancy 03	170	1.7%	-2.00	[-6.22; 2.22]
Goldstein 11	30	2.4%	2.00	[-1.49; 5.49]
Guilloneau 12	61	0.8%	4.0	[-0.48; 8.68]
Kiechl 12	266	1.6%	3.60	[-0.32; 7.52]
Larsson 11	59	8.7%	-0.07	[-1.97; 1.83]
Peterson 14	43	0.4%	-2.30	[-1.62; -0.99]
Volz 08	156	24.9%	0.21	[-0.27; 0.69]
Heterogeneity: I²=37%; p=0.053				
Overall	100% -0.36 [-0.91; 0.23]			
Heterogeneity: I²=29%; p=0.124				
Test for subgroup difference: p=0.026				

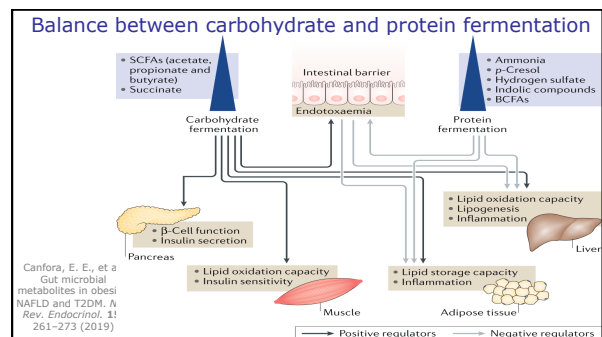
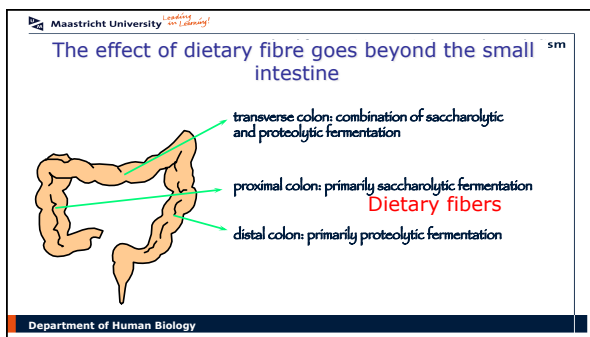
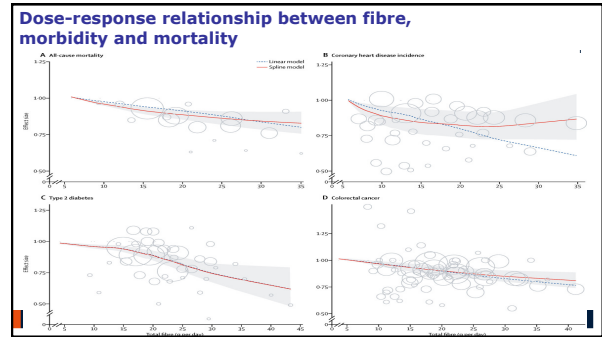


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HK Korsmo-Haugen, KG Brurberg, JM Mann, AM Aas, DOM 2019

Dietary fiber and long term health (Reynolds et al, Lancet 2019)

	Number of studies	Number of cases or number in intervention	Person-years or number of controls	Effect size (95% CI)	GRADE quality
Observational studies					
All-cause mortality	10	80 139	12.3 million person-years	RR 0.85 (0.79 to 0.91)	Moderate
Coronary heart disease mortality	10	7243	6.9 million person-years	RR 0.69 (0.60 to 0.81)*	Moderate
Coronary heart disease incidence	9	7155	2.7 million person-years	RR 0.76 (0.69 to 0.83)	Moderate
Stroke mortality	2	1103	1.3 million person-years	RR 0.80 (0.56 to 1.14)	Very low
Stroke incidence	9	13 134	4.6 million person-years	RR 0.78 (0.69 to 0.88)*	Low
Type 2 diabetes incidence	17	48 468	6.9 million person-years	RR 0.84 (0.78 to 0.90)	Moderate
Colorectal cancer incidence	22	22 920	16.9 million person-years	RR 0.84 (0.78 to 0.89)	Moderate
Cancer mortality	5	79 593	11.2 million person-years	RR 0.87 (0.79 to 0.95)	Moderate
Randomised trials					
Change in bodyweight (kg)	27	1204	1201	MD -0.37 (-0.63 to -0.11)	High
Change in glycosylated haemoglobin A _{1c} (%)	6	191	189	SMD -0.35 (-0.73 to 0.03)	Low
Change in total cholesterol (mmol/L)	36	1832	1671	MD -0.15* (-0.22 to -0.07)	Moderate
Change in systolic blood pressure (mm Hg)	35	1064	988	MD -1.27* (-2.50 to -0.04)	Moderate

RR=relative risk, MD=mean difference, SMD=standardised mean difference. *Fisher's test for bias (p=0.0040). Trim and fill analysis did not change the direction or significance of the pooled estimate. (The high heterogeneity of the pooled effect size (>50%) is unexplained by sensitivity analyses.)



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EDIPS trial

Importance of Weight Loss Maintenance and Risk Prediction in the Prevention of Type 2 Diabetes:
Analysis of European Diabetes Prevention Study RCT

Linda Penn, Martin White, Jaana Lindström, Annemieke Th. den Boer, Ellen Blaak, Johan G. Eriksson, Edith Feskens, Pirjo Ilanne-Parikka, Sirkka M. Keinänen-Kiukaanniemi, Mark Walker, John C. Mathers, Matti Uusitupa, Jaakko Tuomilehto, PLOS one, February 25, 2013

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type 2 diabetes by trial arm.

Cumulative incidence of diabetes reduced by 57%!

Year of participation in EDIPS RCT	Intervention (Proportion)	Control (Proportion)
0	1.00	1.00
1	0.98	0.95
2	0.95	0.85
3	0.92	0.75
4	0.88	0.65
5	0.82	0.55
6	0.75	0.45

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Geen groot gewichtsverlies, maar
Leefstijlveranderingen gericht op een gezonde leefstijl

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www.glasbergen.com

"I tried all the fitness fads, but my doctor was right all along—walking is still the best exercise."

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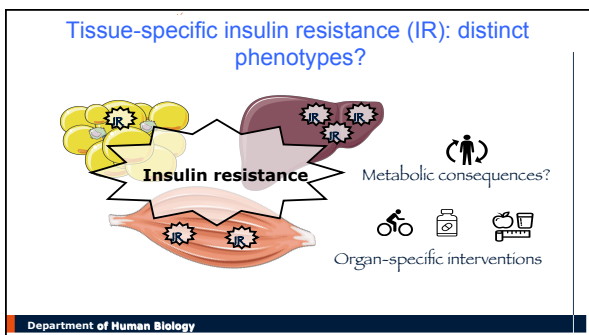
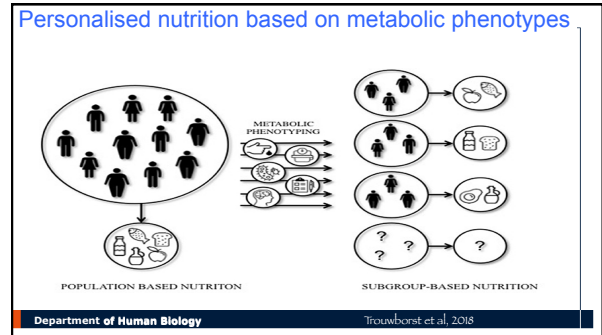
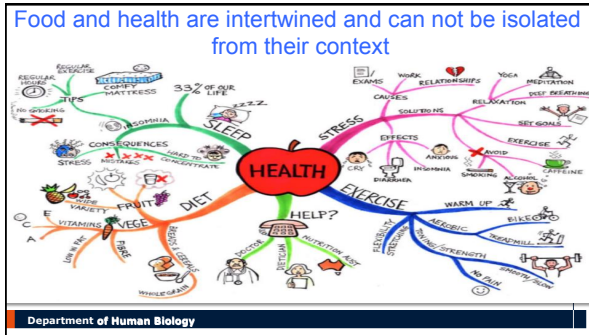
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Protein, fat or CHO: what is the optimal mix?

Based on metabolic phenotype?
The diet the patient can enjoy and stick to!

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Muscle IR and hepatic IR are distinct metabolic phenotypes

But do these phenotypes respond differentially to diet?

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Response to dietary intervention may depend on initial insulin resistance phenotype and diet composition

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Conclusions

- Een voeding volgens richtlijnen goede voeding gericht op meer plantaardige producten, een reductie van suikerhoudende dranken en een vervanging van geraffineerde graanproducten door volkoren producten is effectief in de preventie van chronisch metabole ziekten
- Sterke koolhydraatrestrictie gaat gepaard met een lage vezel inname wat niet wenselijk lijkt met het oog op lange termijn gezondheid
- Focuss moet gericht zijn op een gezonde leefstijl en niet op gewichtreductie per se
- Binnen de context van een gebalanceerde voeding kan een meer gepersonaliseerde aanpak voor mensen met een verhoogd risico op type 2 diabetes en cardiometabole complicaties effectief zijn

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