# Liikunta lihavuuden metabolisten liitännäissairauksien hoidossa

- Liikuntalääketieteen päivät 2-3.12.2025

- Leo Niskanen, LKT, dosentti
- Sisätautien ja endokrinologian erikoislääkäri

# Mitä on lihavuus? Tauti vai ei ?

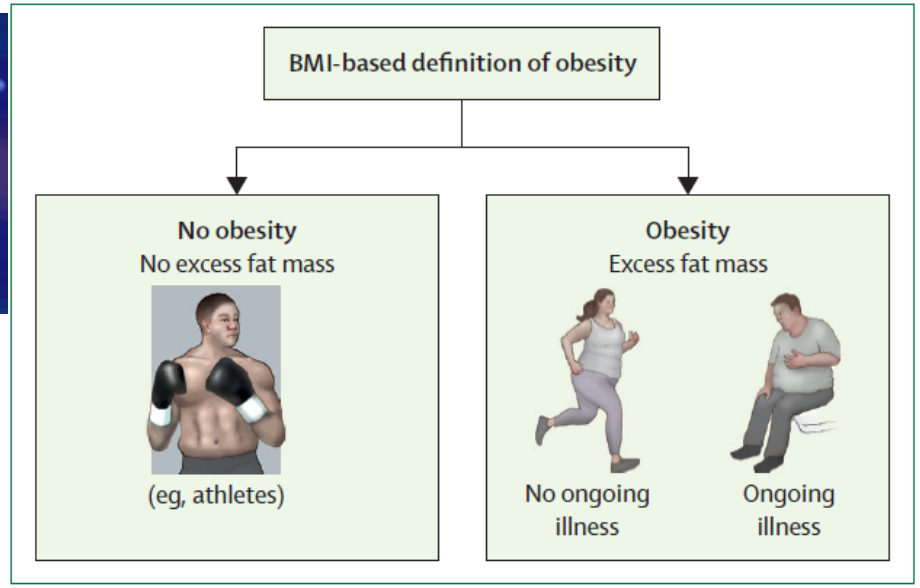
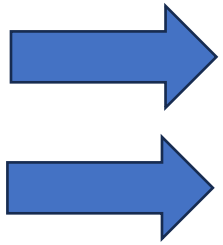




*Figure 2:* **Limitations of the BMI-based definition of obesity**
The current BMI-based definition of obesity (eg, BMI >30 kg/m²) can both underestimate and overestimate adiposity and underdiagnose and overdiagnose illness. BMI does not differentiate between fat and lean mass and does not account for differences in fat distribution. As a result, some individuals with a BMI in the non-obesity range (eg, BMI <30 kg/m² for Europeans) might actually have excess body fat. Conversely, in people with increased skeletal muscles mass, such as athletes, BMI can overdiagnose obesity. Furthermore, BMI provides no information about the functional status of tissues and organs, or the ability of an individual to conduct normal daily activities, two fundamental criteria to assess the presence of an illness.

***Lancet Diabetes Endocrinol* 2025; 13: 221–62**



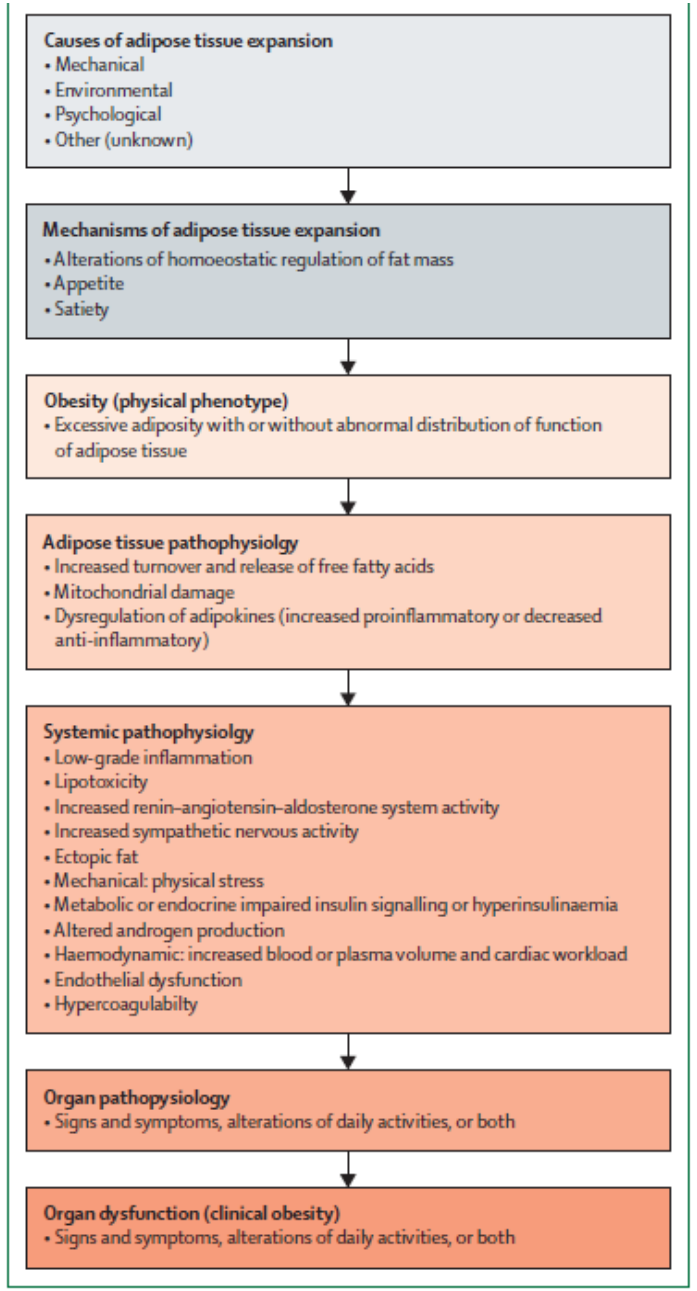
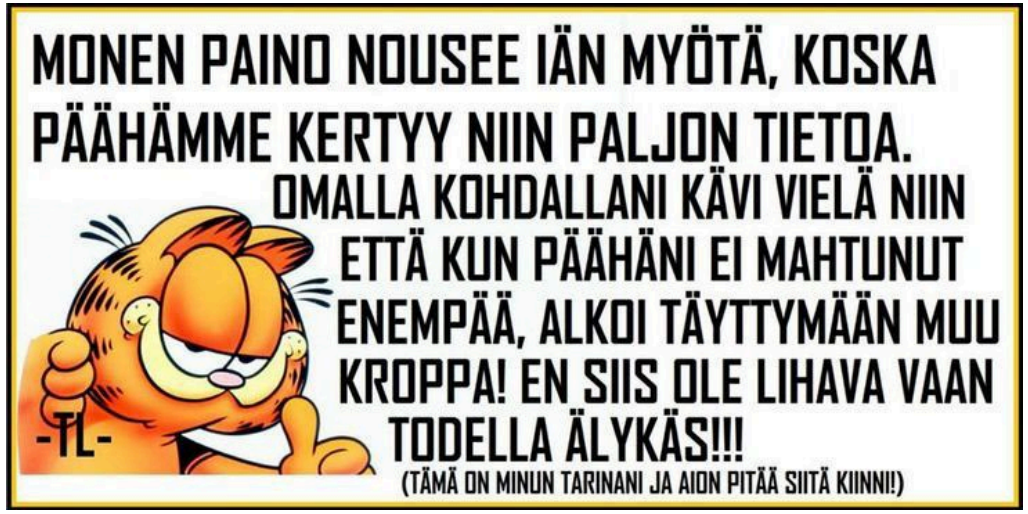



*Figure 3:* **Pathophysiology of clinical obesity**

# The Lancet Diabetes & Endocrinology Commission

- **Definition and diagnostic criteria of clinical obesity**
- *Francesco Rubino, David E Cummings, Robert H Eckel, et al.*
- ***Lancet Diabetes Endocrinol* 2025; 13: 221–62**



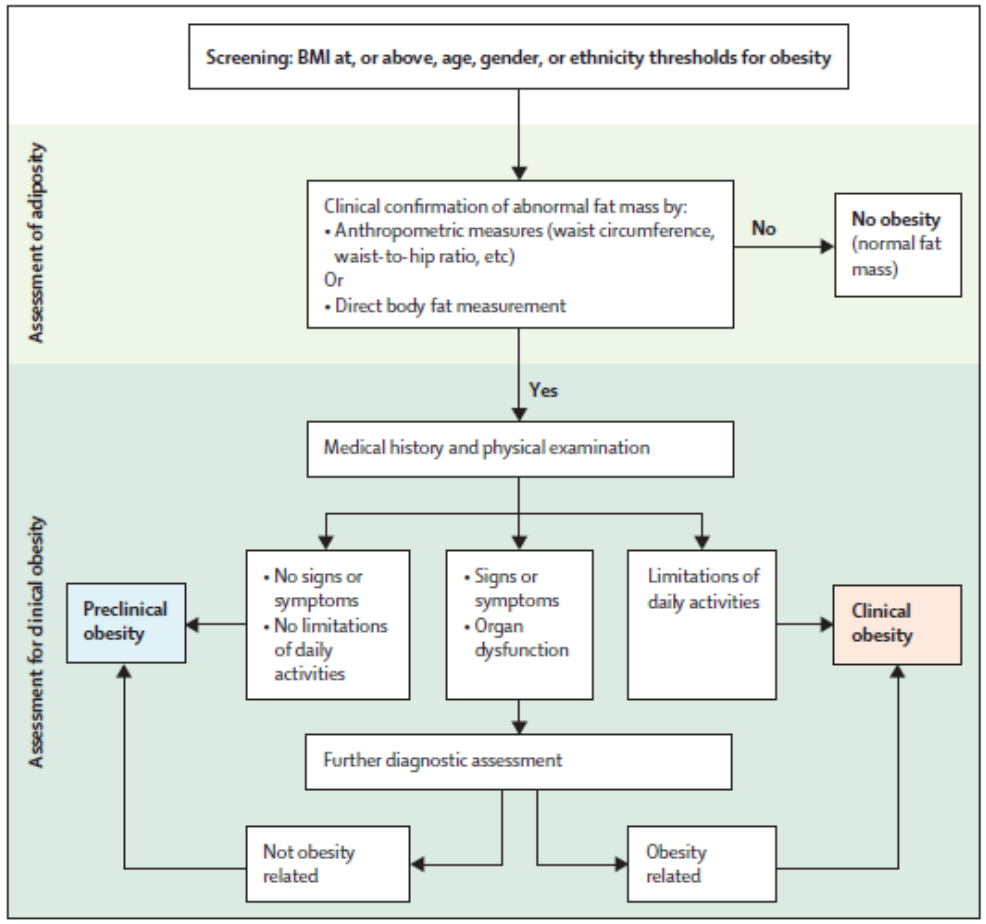




*Figure 8:* Clinical assessment of obesity

# Prekliininen ja kliininen obesiteetti

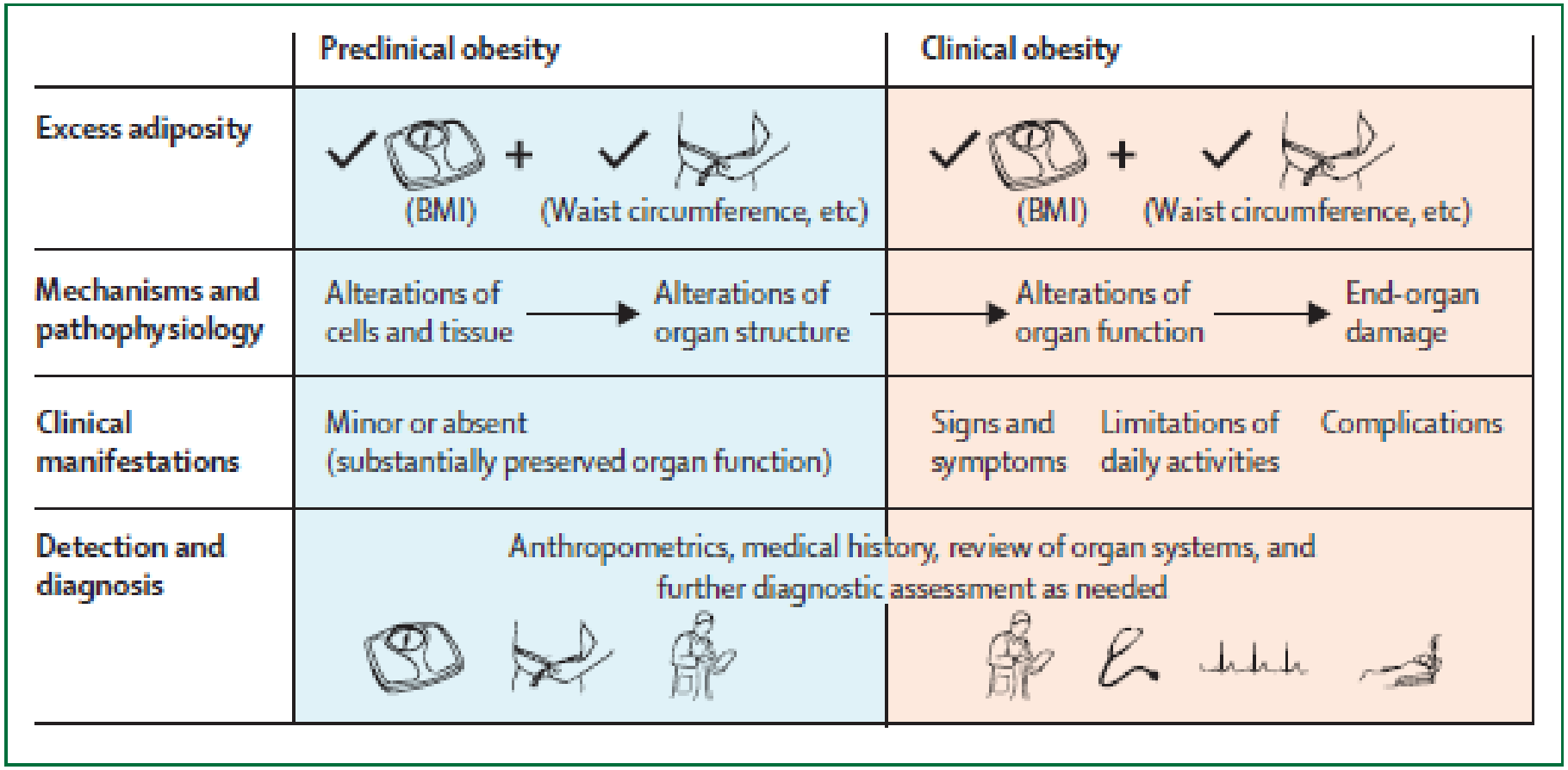



***Figure 4:*** **Clinical and preclinical obesity**
Mechanisms of pathophysiology, clinical manifestations, and methods of detection and diagnosis.

***Lancet Diabetes Endocrinol* 2025; 13: 221–62**

# Kliinisen obesiteetin diagnostiikka (”liitännäisssairaudet”)

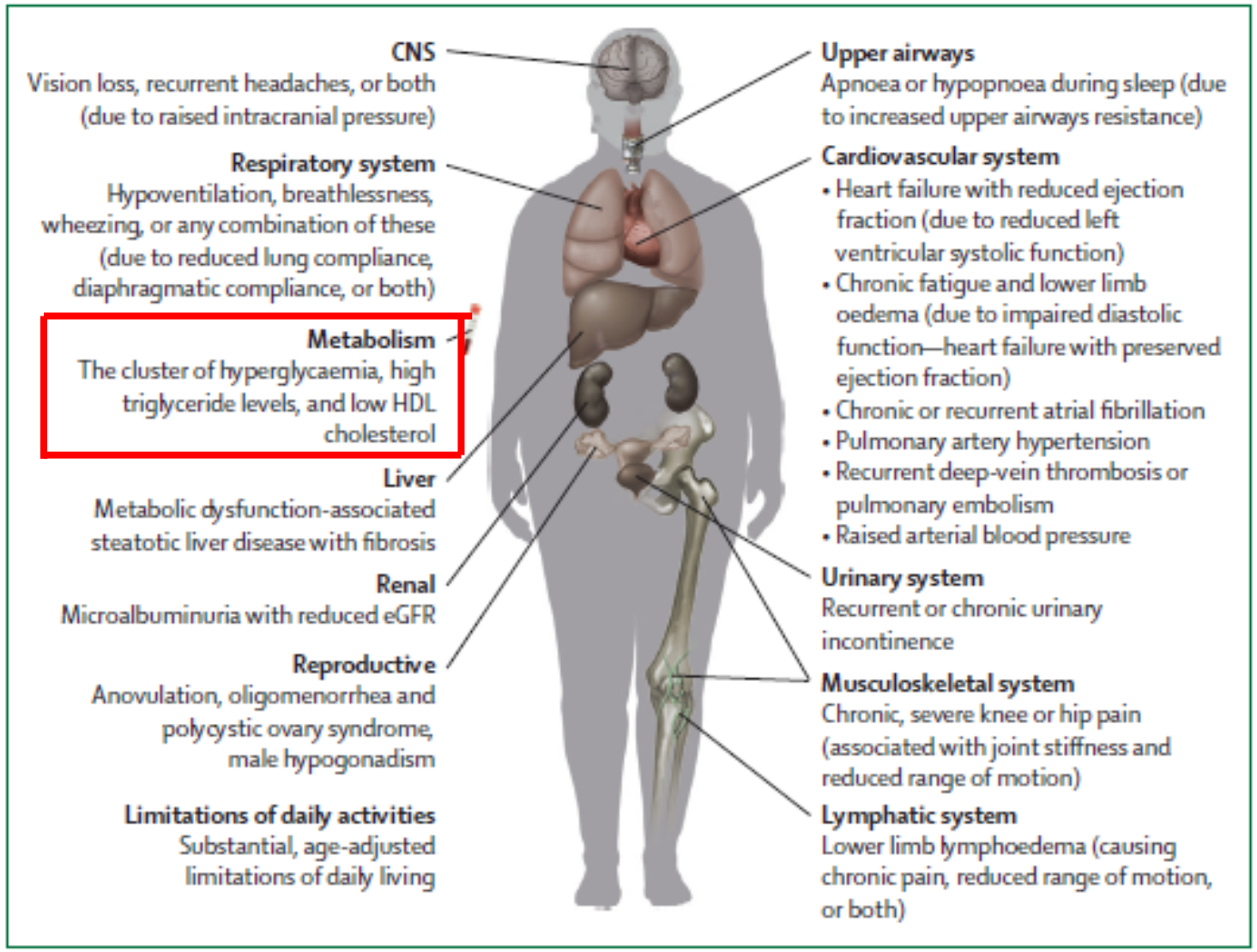
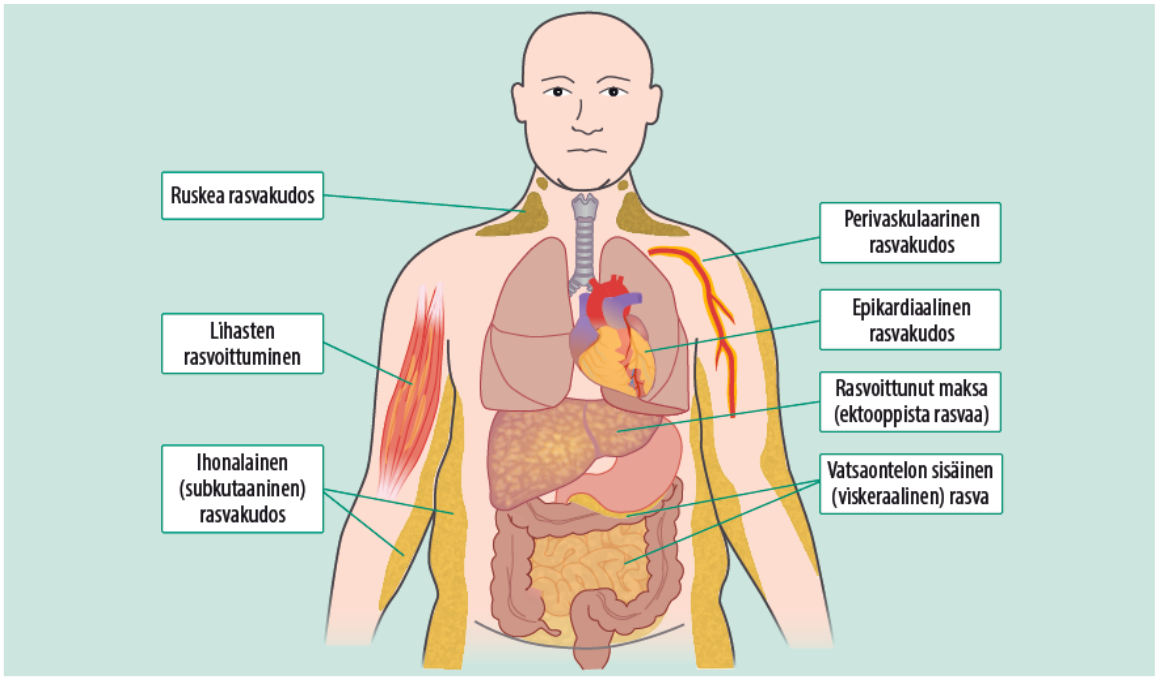


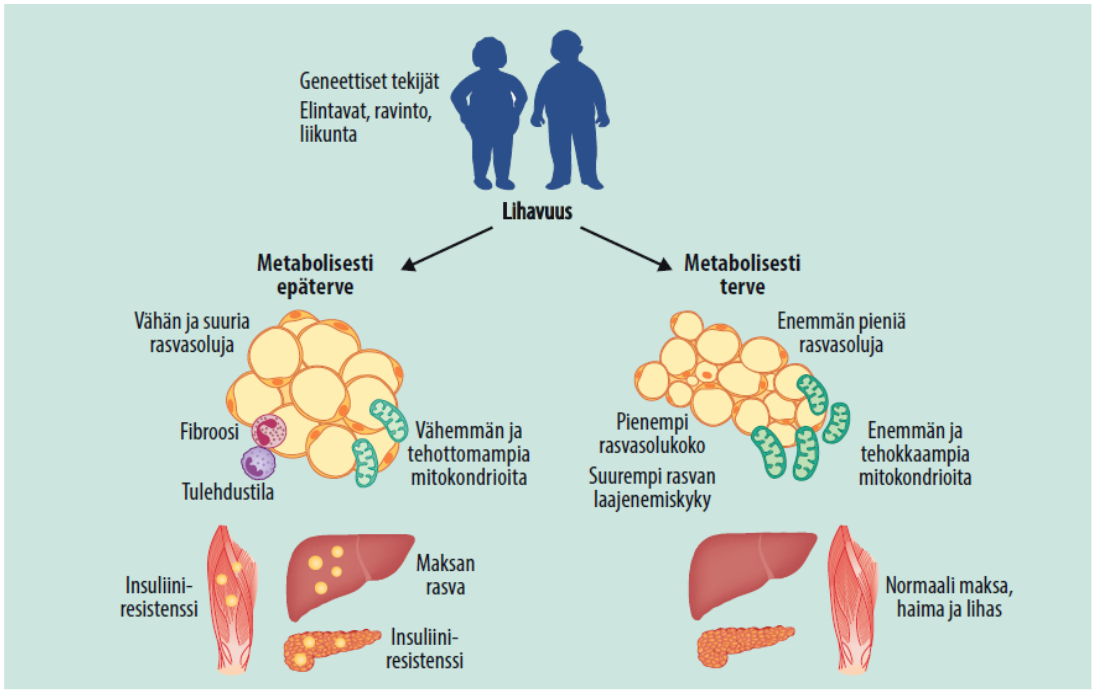

***Figure 6:*** **Diagnostic criteria for clinical obesity in adults**
eGFR=estimated glomerular filtration rate.

- ***Lancet Diabetes Endocrinol* 2025; 13: 221–62**

**TAULUKKO.** Metabolisesti terveen ja epäterveen lihavuuden piirteitä.

| Metabolisesti terve lihavuus | Metabolisesti epäterve lihavuus |
|---|---|
| **Lihavuus ja sen lisäksi** | **Lihavuus ja sen lisäksi** |
| Ei rasvaa maksassa | Maksan rasvoittuminen |
| Normaali insuliiniherkkyys | Heikentynyt glukoosinsieto tai tyypin 2 diabetes |
| Ei kohonnutta verenpainetta | Kohonnut verenpaine |
| Normaali plasman triglyseridipitoisuus | Suurentunut plasman triglyseridipitoisuus |
| Ei kardiometabolisia sairauksia | Jokin tai useita kardiometabolisia sairauksia |




Sini Heinonen ja Jussi Naukkarinen

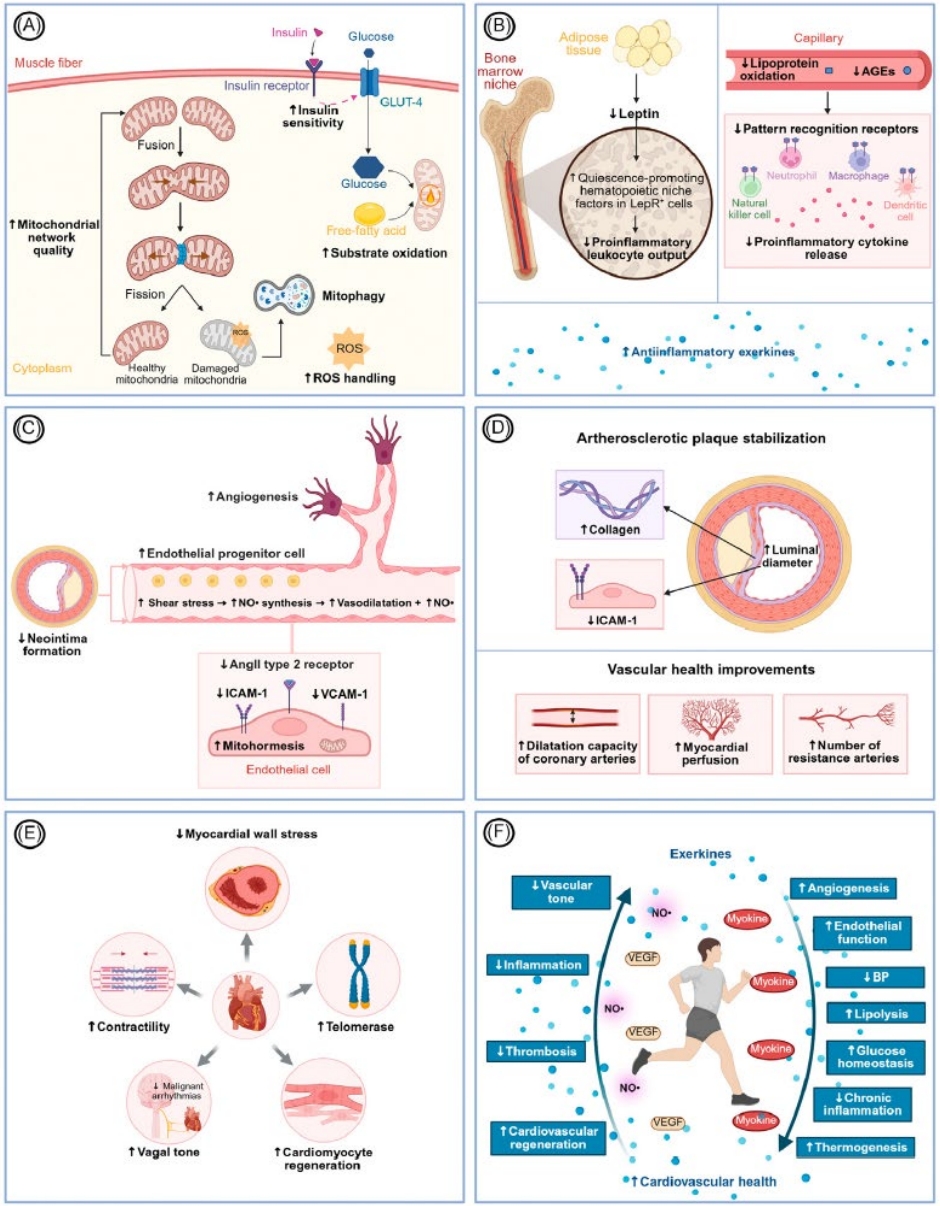
# Rasvakudos metabolisen terveyden määrittäjänä

Duodecim 2025;141:591–7

Although the case for physical inactivity as a cause of obesity is weak, there is clear evidence that it contributes to adverse metabolic effects associated with obesity.


- ***Lancet Diabetes Endocrinol* 2025; 13: 221–62**

# Liikunnan ja inaktiviteetin vaskulaari-metaboliavaikutukset




Trends in Endocrinology & Metabolism, Month 2025, Vol. xx, No. xx https://doi.org/10.1016/j.tem.2025.07.005 & Metabolism

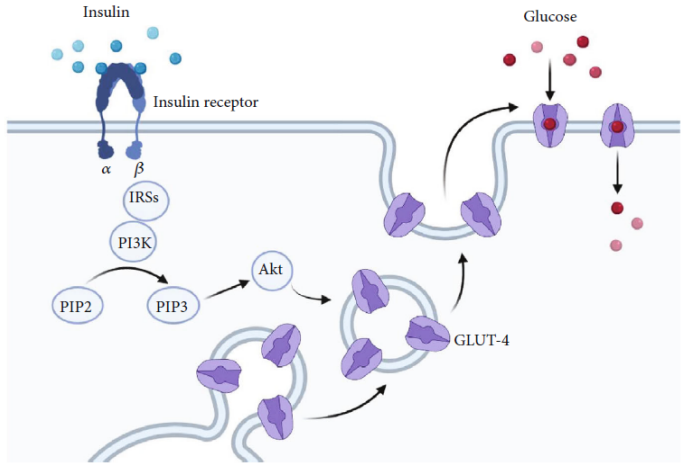



FIGURE 1: Simple schematic pic of insulin signal transduction (IRSs = insulin receptor substrates; PI3K = phosphoinositide 3-kinase; PIP2 = phosphatidylinositol 4,5-bisphosphate; PIP3 = phosphatidylinositol 3,4,5-trisphosphate; Akt = protein kinase B; Glut-4 = glucose transporter type 4).

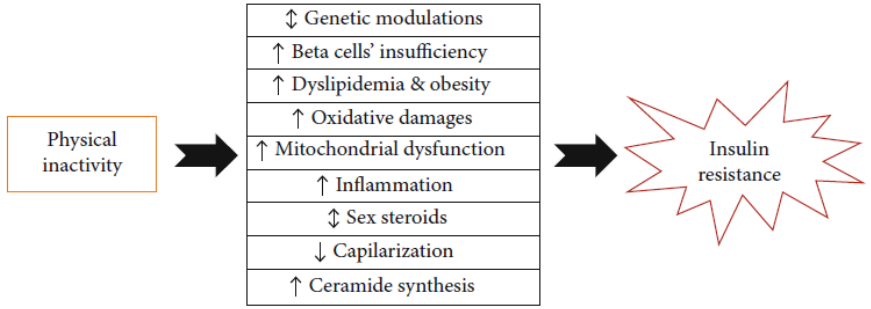
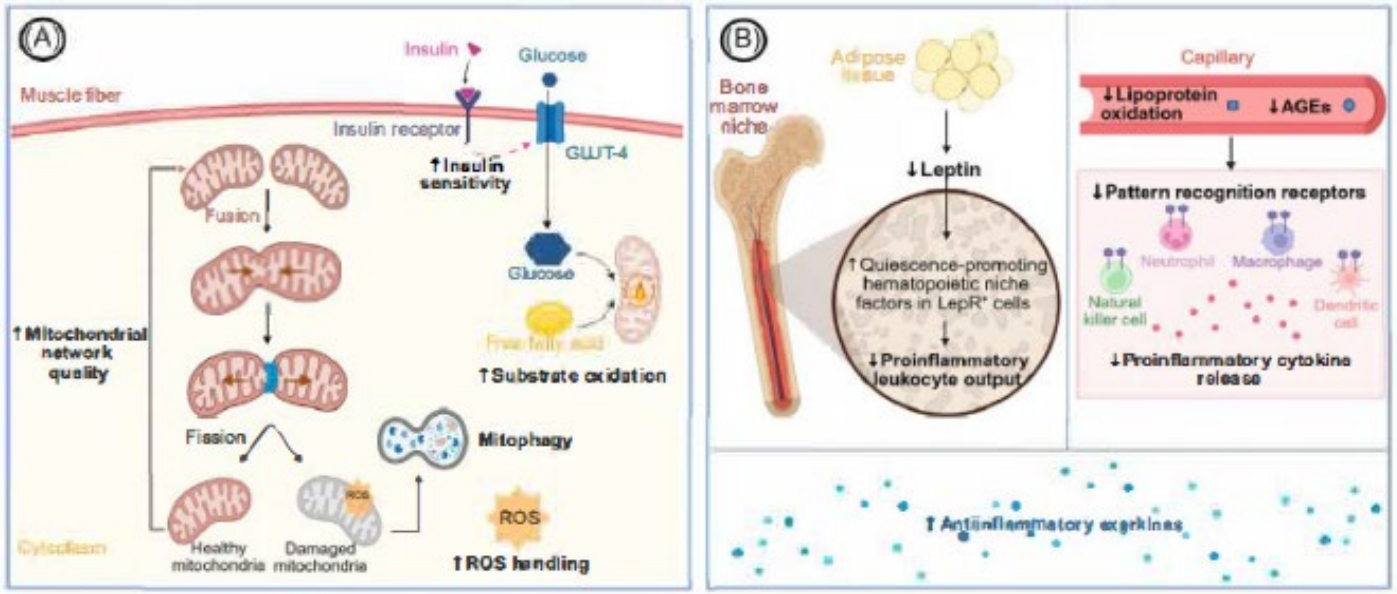
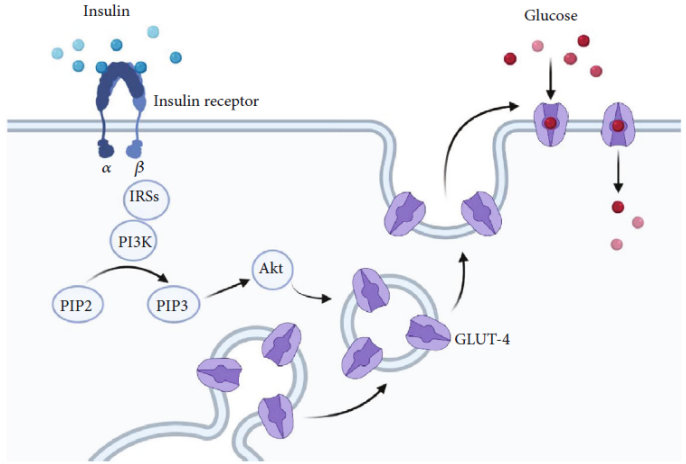



FIGURE 2: Possible links between physical inactivity and insulin resistance.

Journal of Diabetes Research
Volume 2021, Article ID 7796727, 12 pages
https://doi.org/10.1155/2021/7796727

# Liikunnan ja inaktiviteetin vaskulaari-metaboliavaikutukset

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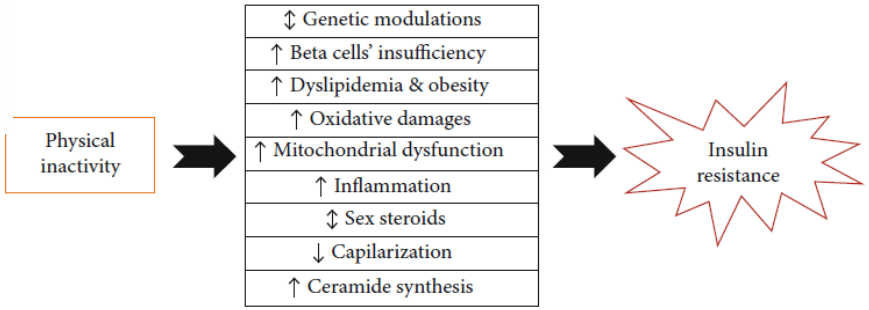


FIGURE 2: Possible links between physical inactivity and insulin resistance.

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https://doi.org/10.1155/2021/7796727

nature metabolism

Article

https://doi.org/10.1038/s42255-024-01103-x

# Years of endurance exercise training remodel abdominal subcutaneous adipose tissue in adults with overweight or obesity

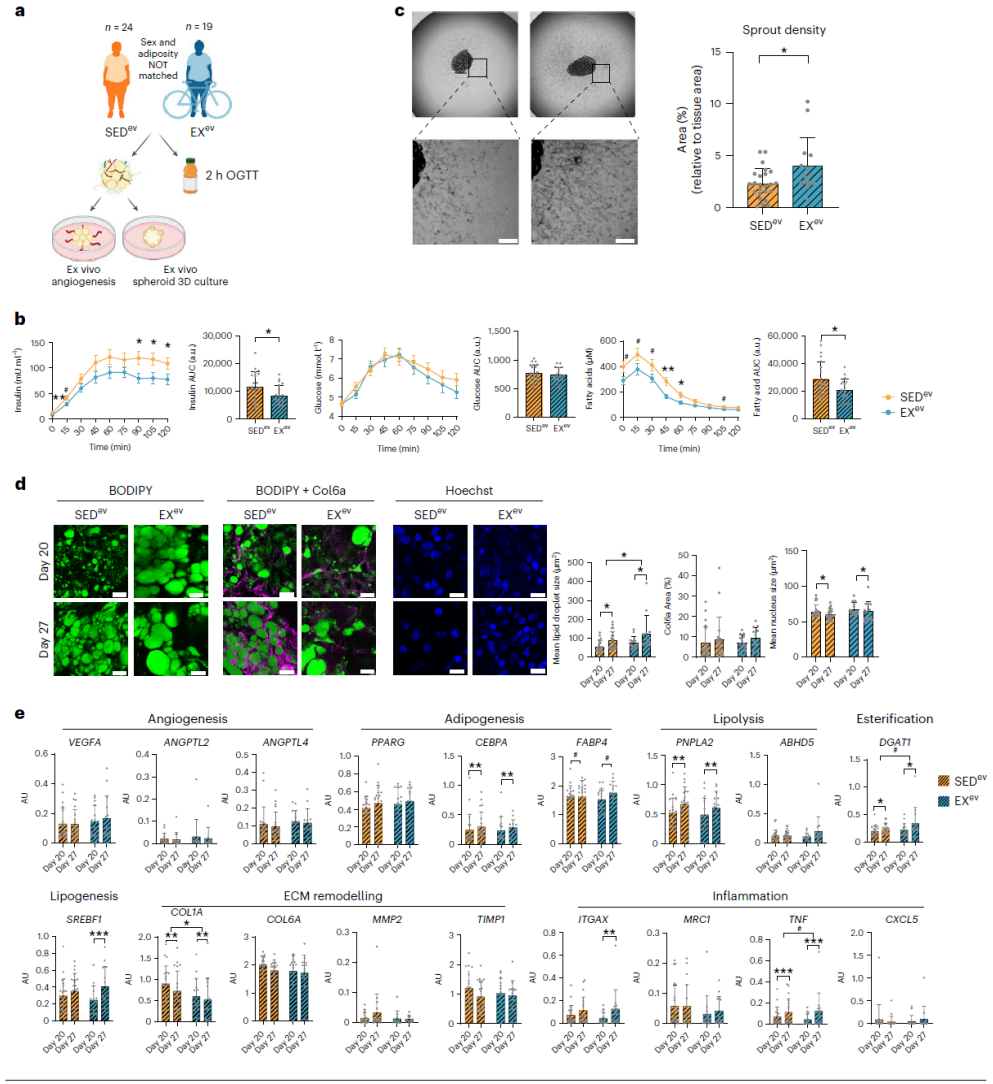
Received: 9 February 2024

Accepted: 9 July 2024

Published online: 10 September 2024

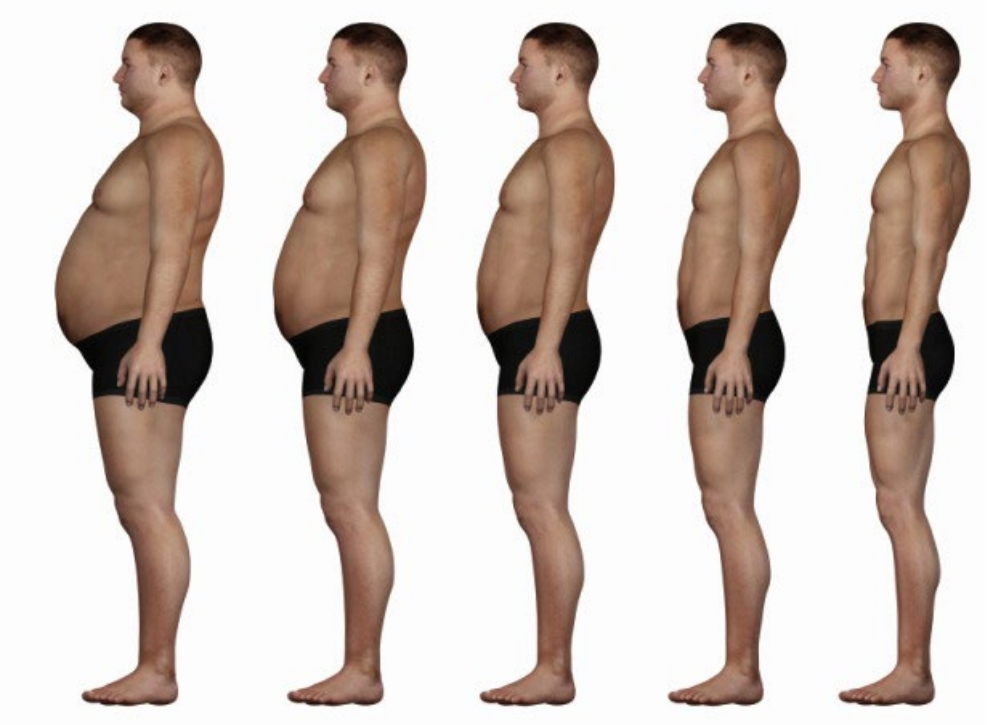
Cheehoon Ahn[1], Tao Zhang[1], Gayoung Yang[1], Thomas Rode[1], Pallavi Varshney[2], Sophia J. Ghayur[1], Olivia K. Chugh[1], Hui Jiang[3] & Jeffrey F. Horowitz[1]

Runsas kestävyysliikunta muokkaa ihonalaisen rasvakudoksen toimintaa terveeseen suuntaan lihavuudesta riippumatta. Rasvakudoksessa havaittiin parempi verisuonitus, vähemmän fibroosia ja tulehdusta, enemmän mitokondrioita ja parempi kyky rasvan varastoimiseen

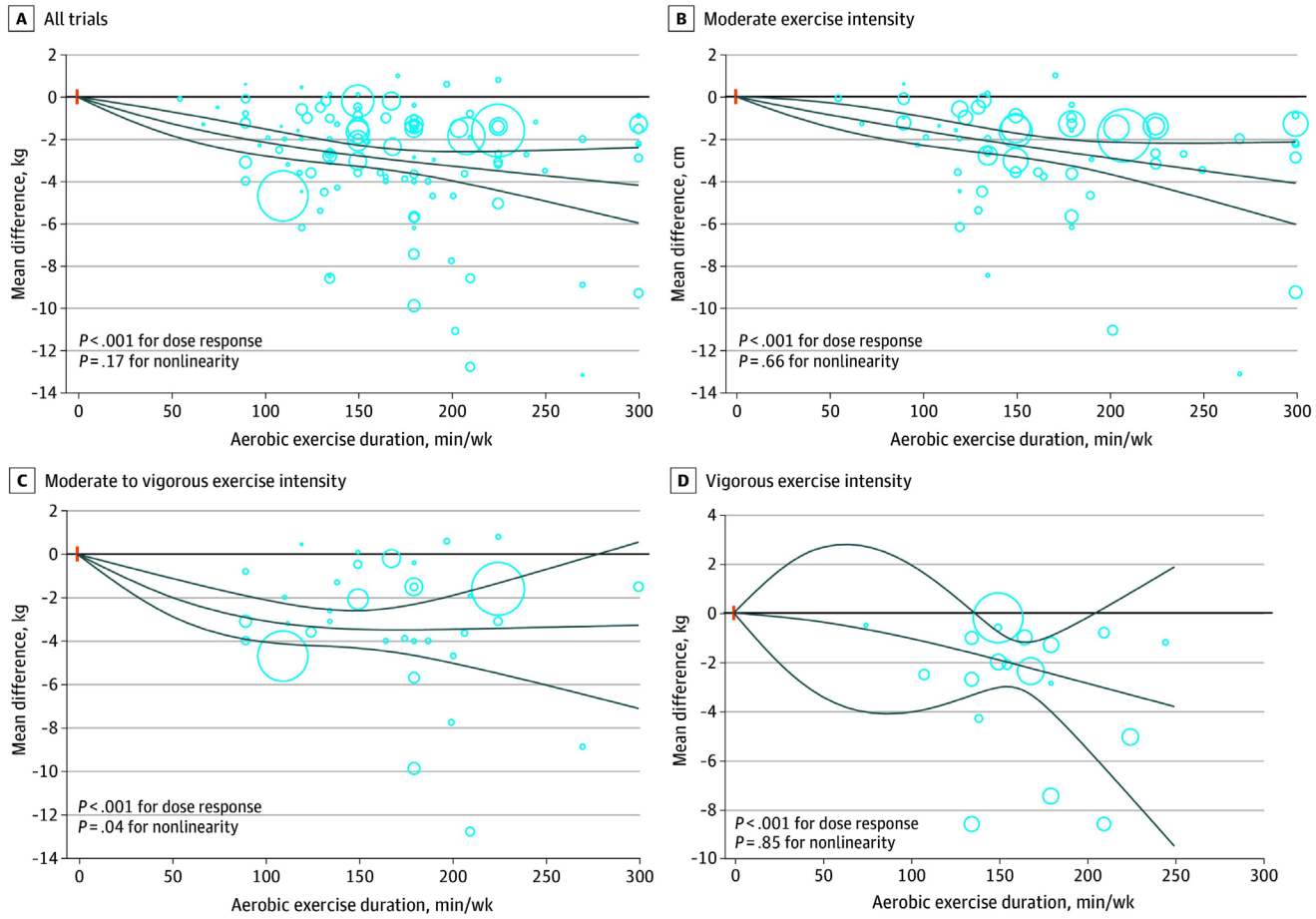


# Liikunta ja paino ylipainoisilla ja obeeseilla

- Annosvaste ?



# Liikunnan annosvaste lihavuudessa




Meta-analyysissä lineaarinen painon lasku aerobisella harjoittelulla ad 300 min/viikko ($P = .17$ for nonlinearity; $P < .001$ for dose response; n = 109 trials) (painon lasku −2.79 kg (95% CI, −3.29 to −2.29 kg) 150 viikkominuutilla ja −4.19 kg (95% CI, −5.98 to −2.41 kg) 300 viikkominuutilla

Jayedi A, Soltani S, Emadi A, Zargar MS, Najafi A. Aerobic Exercise and Weight Loss in Adult Systematic Review and Dose-Response Meta-Analysis. JAMA Netw Open. 2024 Dec 2;7(12):e2452185. doi: 10.1001/jamanetworkopen.2024.52185. PMID: 39724371; PMCID: PMC11672165.

# Diabeteksen (T2) preventio

- Liikunnalla vahva yhteys taudin prediabeteksen vaikeutumisen ehkäisyssä
- Finnish Diabetes Prevention Study: liikunnan ja fyysisen aktiviteetin muutoksen merkitys prediabeteksessa korkean riskin henkilöillä (IGT eli impaired glucose tolerance)

**Suuren riskin potilaiden elintapaohjaus: DPS-tutkimuksen menetelmät pohjautuvat näyttöön**

**1.Laihtuminen > 5 %:a**
**2. Ruokavalion rasva < 30 E%,**
**3. Tyydyttynyt rasva< 10 E%, tyydyttymätöntä rasvaa 20-25 E%**
**4. Kuitu 15 g/1000 kcal**
**5. Liikunta > 30 min/vrk**

American Diabetes Association®

# Physical Activity in the Prevention of Type 2 Diabetes

The Finnish Diabetes Prevention Study

**David E. Laaksonen,[1,2] Jaana Lindstro¨ m,[3] Timo A. Lakka,[2,4,5] Johan G. Eriksson,[3] Leo Niskanen,[1] Katja Wikstrom,[3] Sirkka Aunola,[6,7] Sirkka Keina¨ nen-Kiukaanniemi,[8,9] Mauri Laakso,[8] Timo T. Valle,[3] Pirjo Ilanne-Parikka,[10,11] Anne Louheranta,[12] Helena Hamalainen,[7] Merja Rastas,[3,7] Virpi Salminen,[13] Zygimantas Cepaitis,[3] Martti Hakuma¨ ki,[2,12] Hannu Kaikkonen,[8,9] Pirjo Harkonen,[8,9] Jouko Sundvall,[14] Jaakko Tuomilehto,[3,15] and Matti Uusitupa,[12] for the Finnish Diabetes Prevention Study Group**

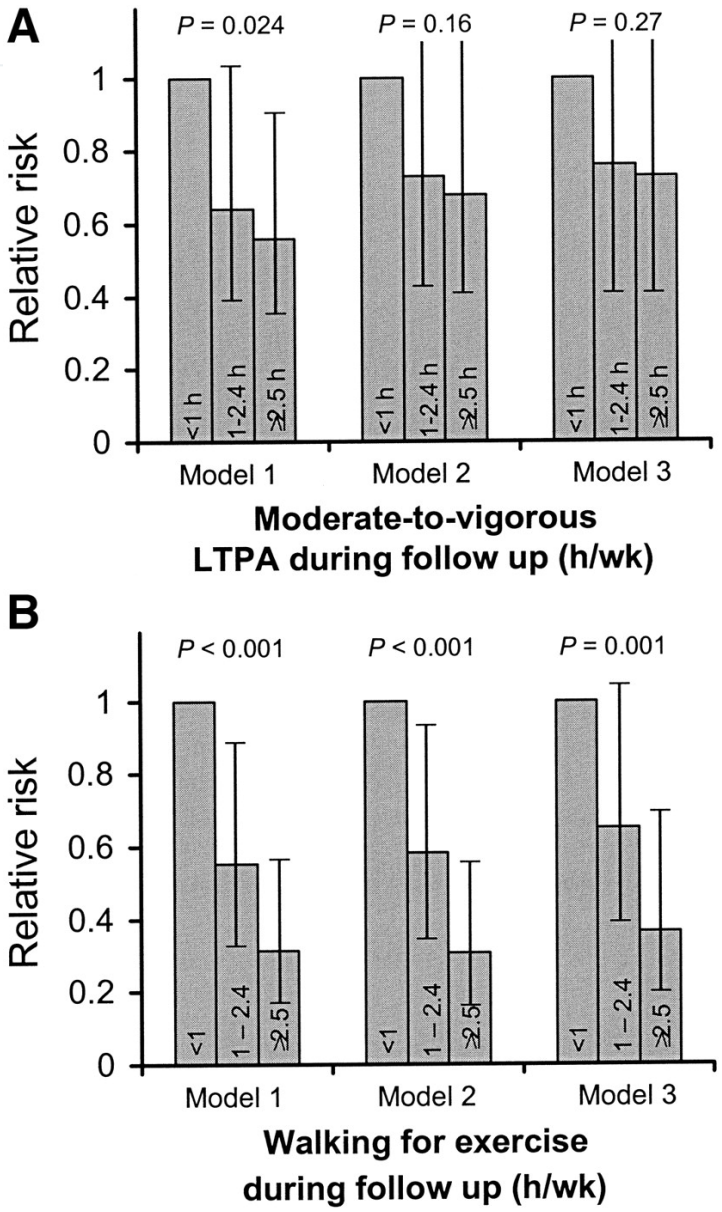
Editorial

Prediabetes: much more than just a risk factor

ww.thelancet.com/diabetes-endocrinology **Vol 13 March 2025**

Diabetes. 2005;54(1):158-165. doi:10.2337/diabetes.54.1.158

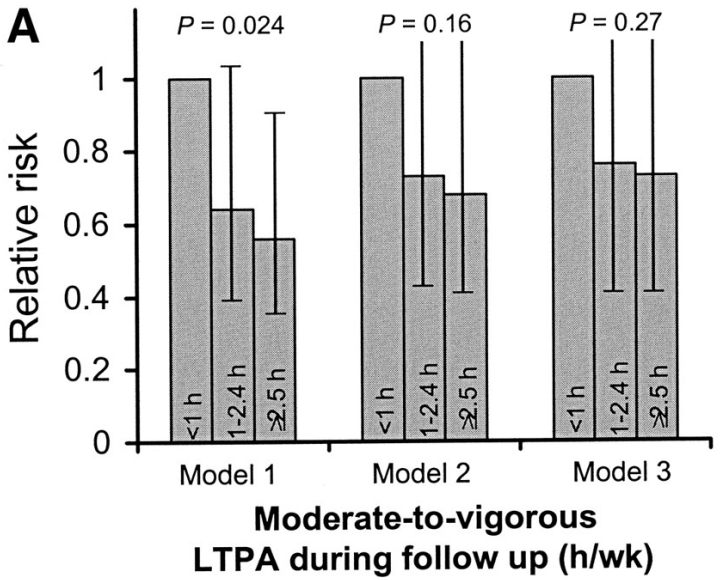
From: **Physical Activity in the Prevention of Type 2 Diabetes The Finnish Diabetes Prevention Study**

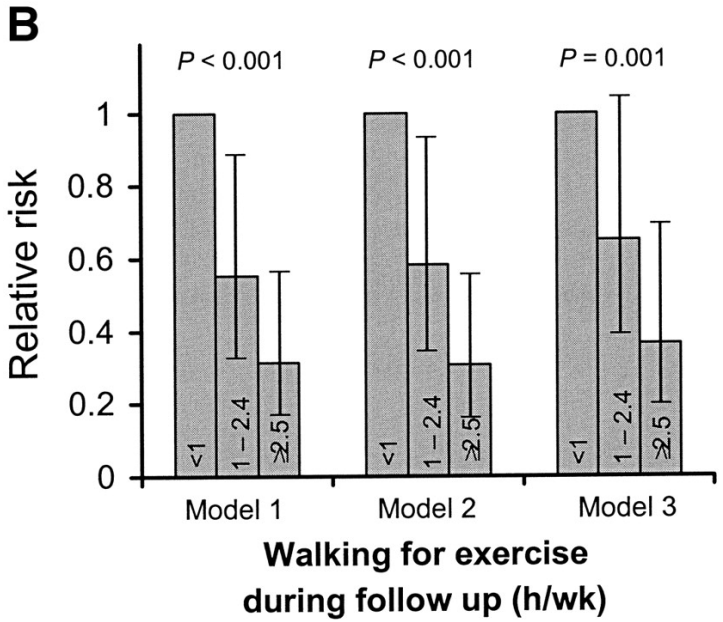



**Model 1:** Adjusted for age, sex, and 1) change in moderate-to-vigorous LTPA from baseline and average low-intensity LTPA during follow-up and its change from baseline, or 2) change in duration of walking for exercise from baseline and other forms of LTPA as in Fig. 1 and their changes from baseline**. Model 2**: Adjusted variables in model 1 and average values of dietary intake of energy, total and saturated fat, and fiber during follow-up and their changes from baseline. **Model 3:** Adjusted for variables in model 2 and average BMI during follow

Diabetes. 2005;54(1):158-165. doi:10.2337/diabetes.54.1.158

From: **Physical Activity in the Prevention of Type 2 Diabetes The Finnish Diabetes Prevention Study**




Atleast 2.5 h/week of walking for exercise during follow-up seemed to decrease the risk of diabetes by 63–69%, largely independent of dietary factors and BMI.

**Model 1**: Adjusted for age, sex, group, the respective form of LTPA at baseline, and the other forms of LTPA and their change). **Model 2:** Adjusted variables in model 1 and baseline values and changes in dietary intake of energy, total and saturated fat, and fiber. **Model 3:** Adjusted for variables in model 2 and baseline values and changes in BMI.

Diabetes. 2005;54(1):158-165. doi:10.2337/diabetes.54.1.158

# Tyypin 2  diabetes ja liikunta

- Liikunta lisää myös tyypin 2 diabetesta sairastavan insuliiniherkkyyttä → lihakset pystyvät helpommin käyttämään glukoosia energiaksi ja glukoositaso laskee.’
- Aerobisen kestävyysliikunnan (kävely, hölkkä, pyöräily, hiihto, soutu) että kuntosalityyppisen lihaskuntoharjoittelun on osoitettu parantavan glukoositasapainoa tyypin 2 diabetesta sairastavilla.
- Insuliiniherkkyyden koheneminen kestää vain 1–2 vuorokautta, liikuntaa tulee harrastaa vähintään joka toinen päivä, jotta saataisiin aikaan myös glukohemoglobiinitason paraneminen. Tällöin on myös mahdollista, että haiman insuliinineritys hieman kohenee, mikä edelleen parantaa $HbA_{1c}$-arvoa.
- Säännöllinen liikunta parantaa glukoositasapainoa tyypin 2 diabeteksessa. Liikunnan positiivinen vaikutus $HbA_{1c}$-arvoihin on kuitenkin rajallinen, varsinkin, jos diabetes on kestänyt jo useita vuosia. Useimmissa tutkimuksissa vaikutus on ollut alle 10 mmol/mol.
- Jos verenglukoositaso on kovin korkea, liikunnalla ei saada aikaan glukoositason laskua
- Huomioitava elinmuutosten vaikutus liikuntaan.

# Liikunta ja (hypokalorinen) ruokavalio

**obesity** reviews

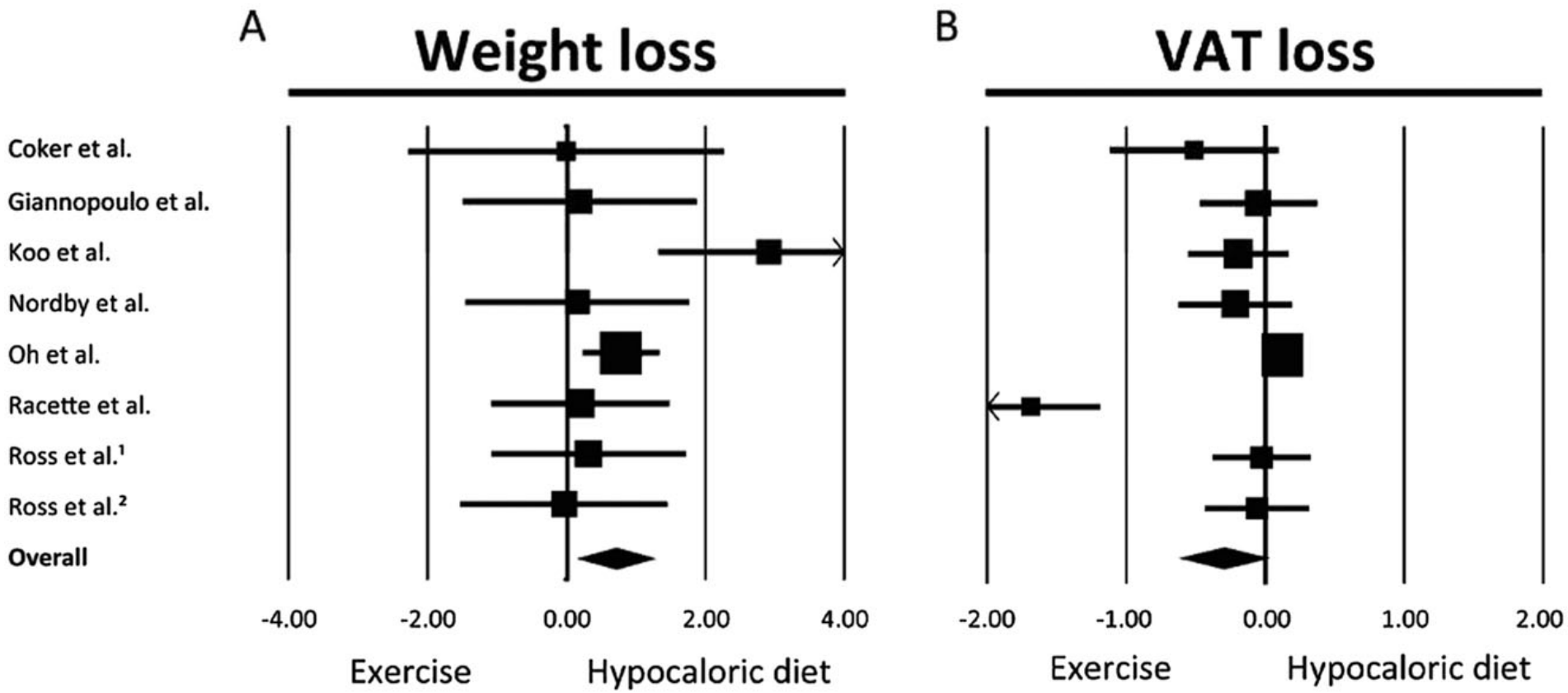
doi: 10.1111/obr.12406

Etiology and Pathophysiology

## A systematic review and meta-analysis on the effects of exercise training versus hypocaloric diet: distinct effects on body weight and visceral adipose tissue

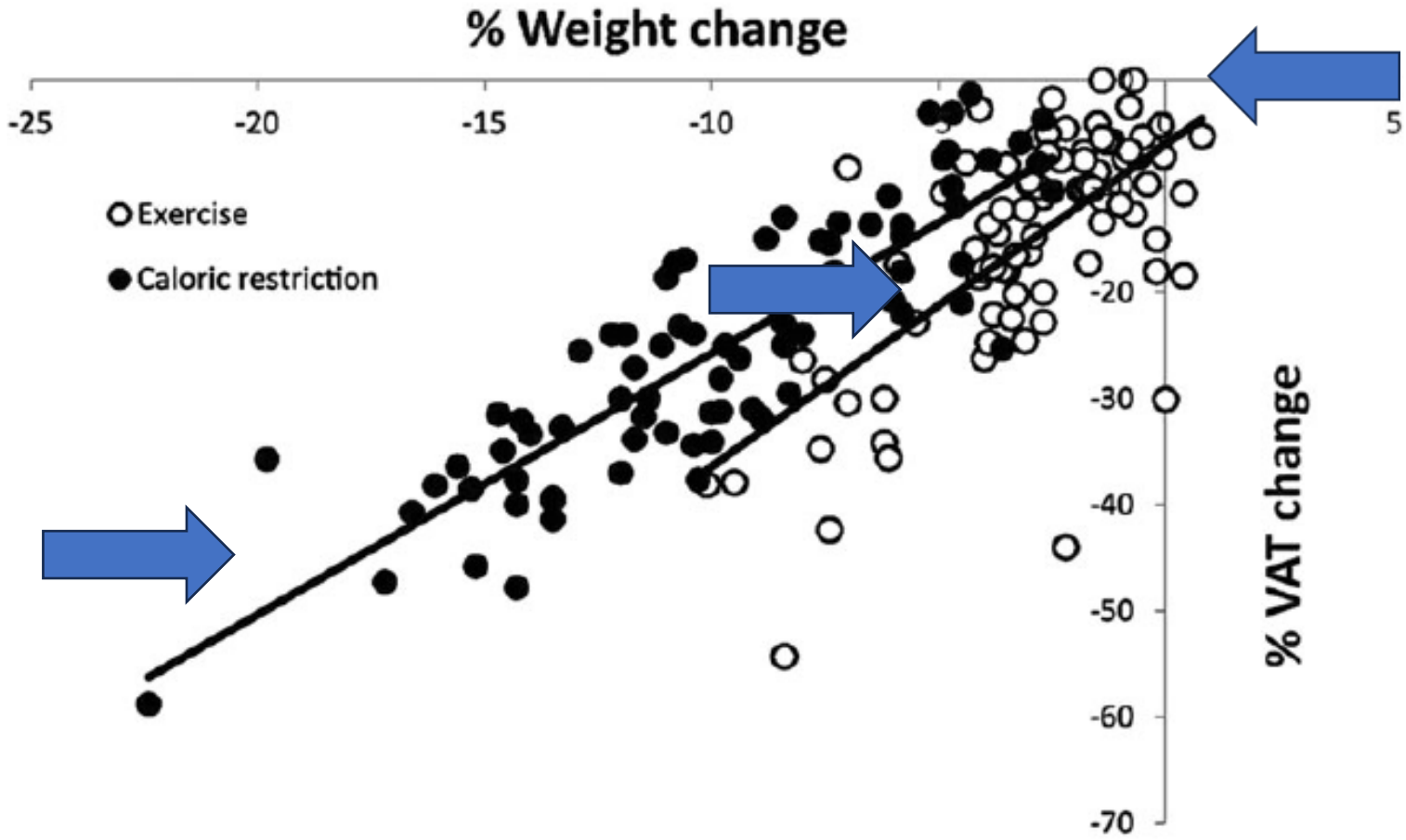
R. J. H. M. Verheggen,[1] M. F. H. Maessen,[1] D. J. Green,[2,3] A. R. M. M. Hermus,[4] M. T. E. Hopman[1] and D. H. T. Thijssen[1,2]

# Liikunta ja (hypokalorinen) ruokavalio




**obesity** reviews (2016) **17**, 664–690

# Liikunta ja (hypokalorinen) ruokavalio




**obesity** reviews (2016) **17**, 664–690

# Aerobinen vs. lihaskuntoharjoittelu: viskeraalirasva

**obesity** reviews

doi: 10.1111/j.1467-789X.2011.00931.x

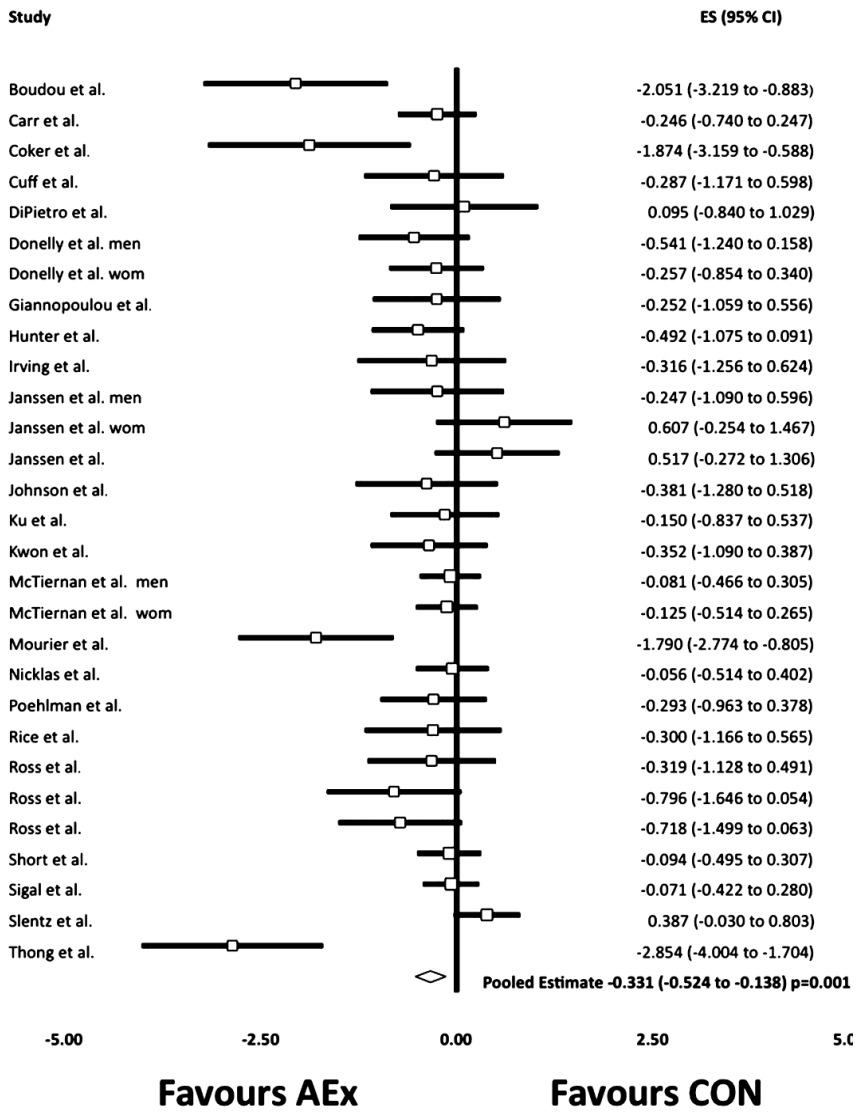
**Obesity Treatment/Management**

## A systematic review and meta-analysis of the effect of aerobic vs. resistance exercise training on visceral fat

I. Ismail[1], S. E. Keating[1], M. K. Baker[2,3] and N. A. Johnson[1,3]

**obesity** reviews (2012) **13**, 68–91

# Viskeraalinen rasva: Aerobinen tai lihaskuntoharjoittelu ?



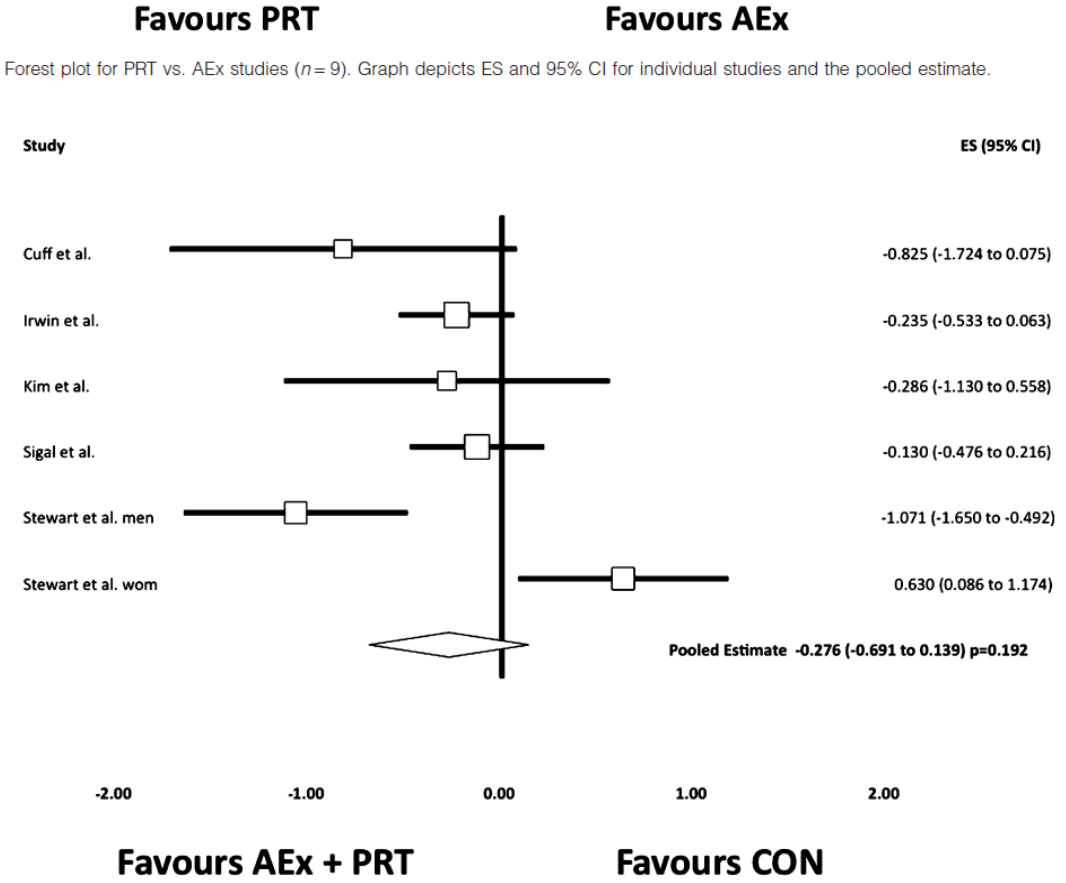




**Figure 4** Forest plot for PRT vs. AEx studies ($n = 9$). Graph depicts ES and 95% CI for individual studies and the pooled estimate.

**obesity** reviews (2012) **13**, 68–91

ESC European Society of Cardiology

European Heart Journal Open (2025) **5**, oeaf093
https://doi.org/10.1093/ehjopen/oeaf093

**REVIEW**
*Miscellaneous*

# The effect of different resistance exercise training intensities on cardiovascular risk factors: a systematic review and meta-analysis

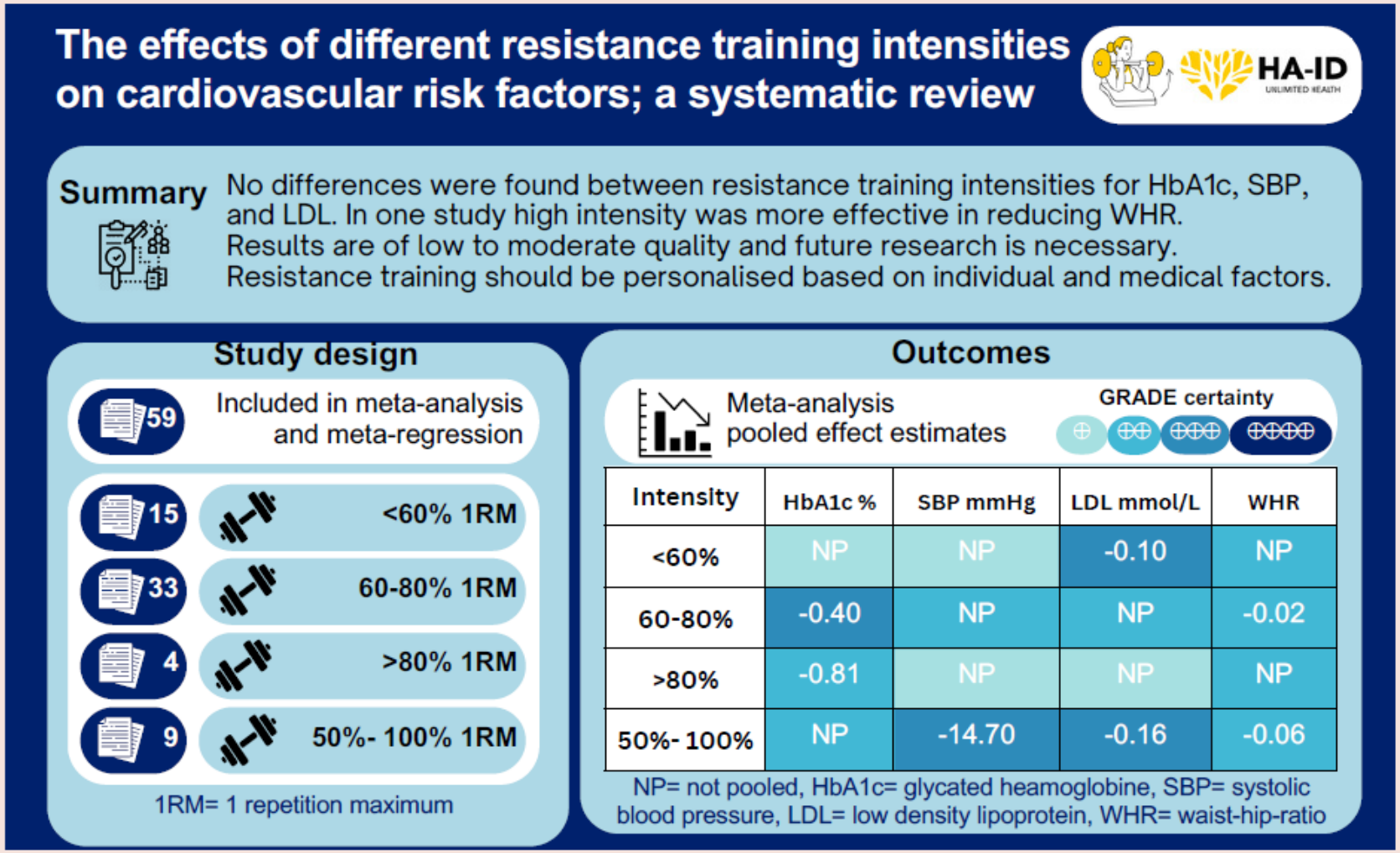
**Kirsten I. de Oude [1,2,*], Roy G. Elbers [1,2], Heike Gerger [3,4], Dederieke A.M. Maes-Festen [1,2], and Alyt Oppewal [1,2]**

[1]Department of General Practice, Intellectual Disability Medicine Research, Erasmus MC, University Medical Center Rotterdam, NA 1909, P.O. Box 2040, Rotterdam, 3000 CA, The Netherlands; [2]Academic Collaborative Research Center Healthy Ageing and Intellectual Disabilities, NA 1909, P.O. Box 2040, Rotterdam, 3000 CA, The Netherlands; [3]Department of General Practice, Erasmus MC, University Medical Center Rotterdam, Rotterdam, NA 1909, P.O. Box 2040, Rotterdam, 3000 CA, The Netherlands; and [4]Faculty of Psychology, Department of Clinical Psychology, Open University of the Netherlands, P.O. Box 2960, Heerlen, 6401 DL, The Netherlands

*Received 19 May 2025; revised 12 June 2025; accepted 30 July 2025; online publish-ahead-of-print 12 August 2025*

Handling Editor: Magnus Bäck

## Graphical abstract




**Keywords** Cardiovascular risk factors • Resistance training • Blood pressure • Cholesterol • Diabetes Mellitus • Obesity

# HIITistä apua ?

Comparative effectiveness of high-intensity interval training and moderate-intensity continuous training on cardiometabolic health in patients with diabesity: a systematic review
ed controlled

iabetology & Metabolic Syndrome

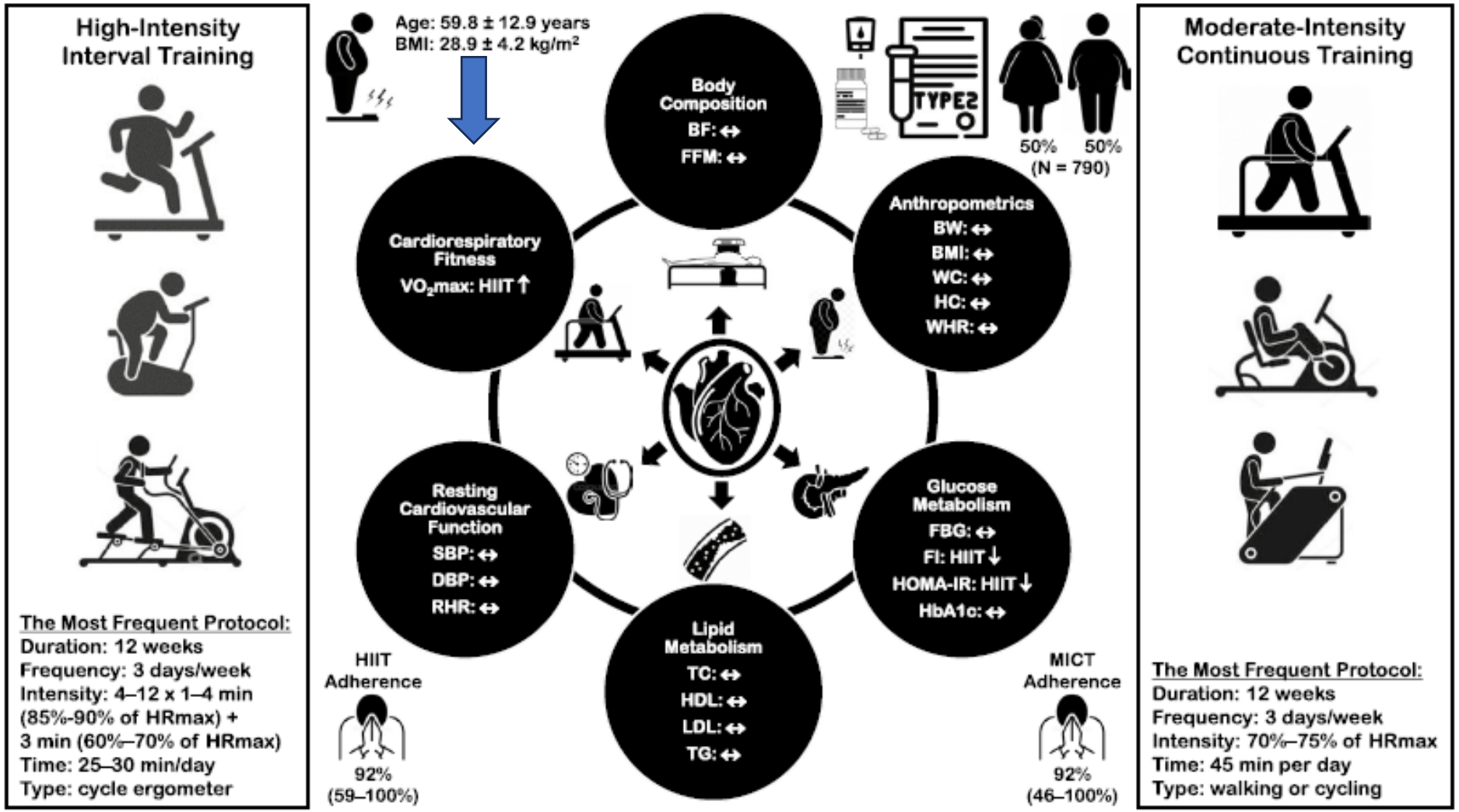



**Fig. 3** Graphic overview of results. BF: Body Fat, BMI: Body Mass Index, BW: Body Weight, DBP: Diastolic Blood Pressure, FBG: Fasting Blood Glucose, FFM: Fat-Free Mass, FI: Fasting Insulin, HbA1c: Glycated Hemoglobin, HC: Hip Circumference, HDL-C: High-Density Lipoprotein Cholesterol, HIIT: High-Intensity Interval Training, HOMA-IR: Homeostatic Model Assessment for Insulin Resistance, HRmax: Maximum Heart Rate, LDL-C: Low-Density Lipoprotein Cholesterol, MICT: Moderate-Intensity Continuous Training, RHR: Resting Heart Rate, SBP: Systolic Blood Pressure, TC: Total Cholesterol, TG: Triglycerides, $VO_2$max: Maximum Oxygen Consumption, WC: Waist Circumference, WHR: Waist-to-Hip Ratio

# HIITistä apua ?

Comparative effectiveness of high-intensity interval training and moderate-intensity continuous training on cardiometabolic health in patients with diabesity: a systematic review
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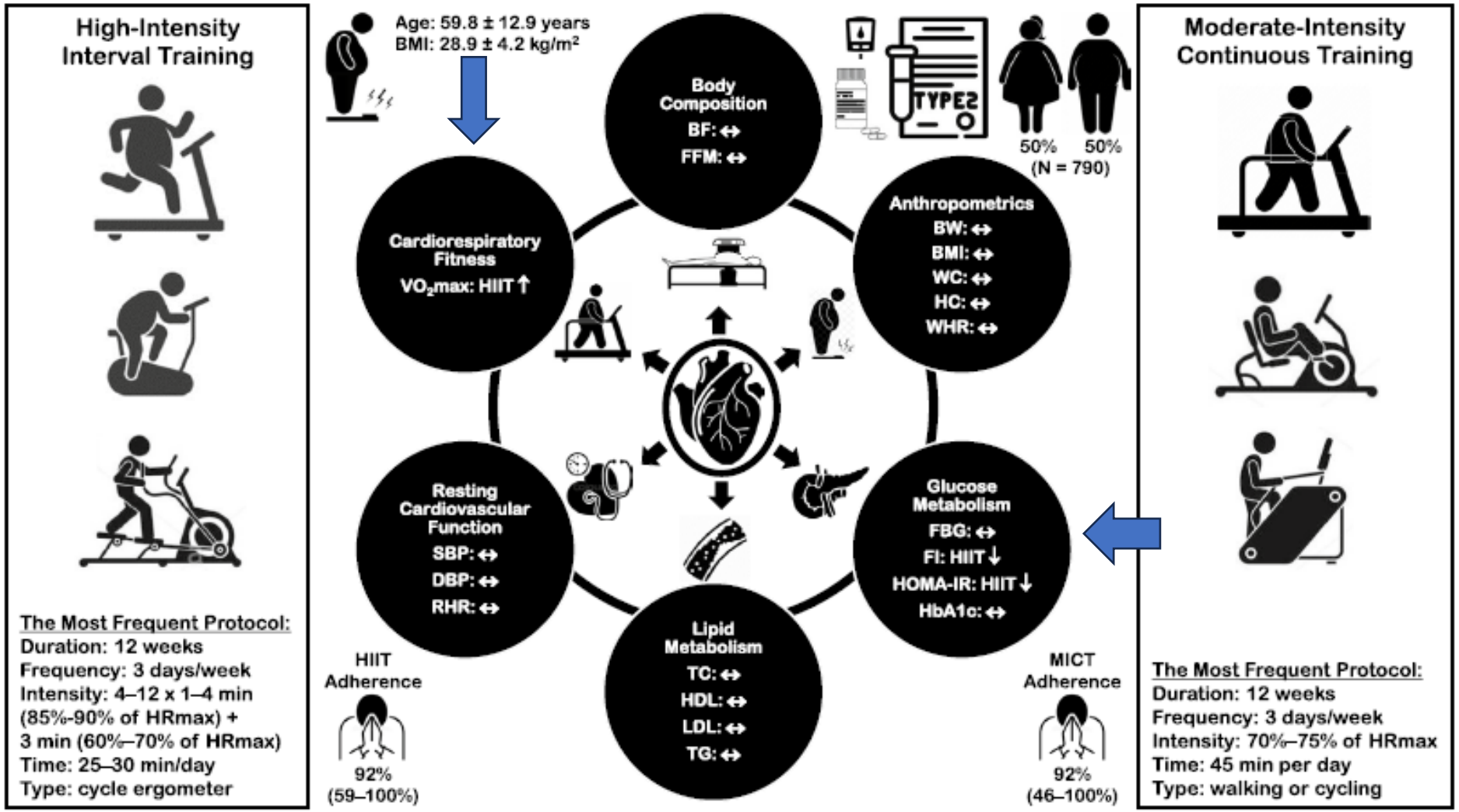
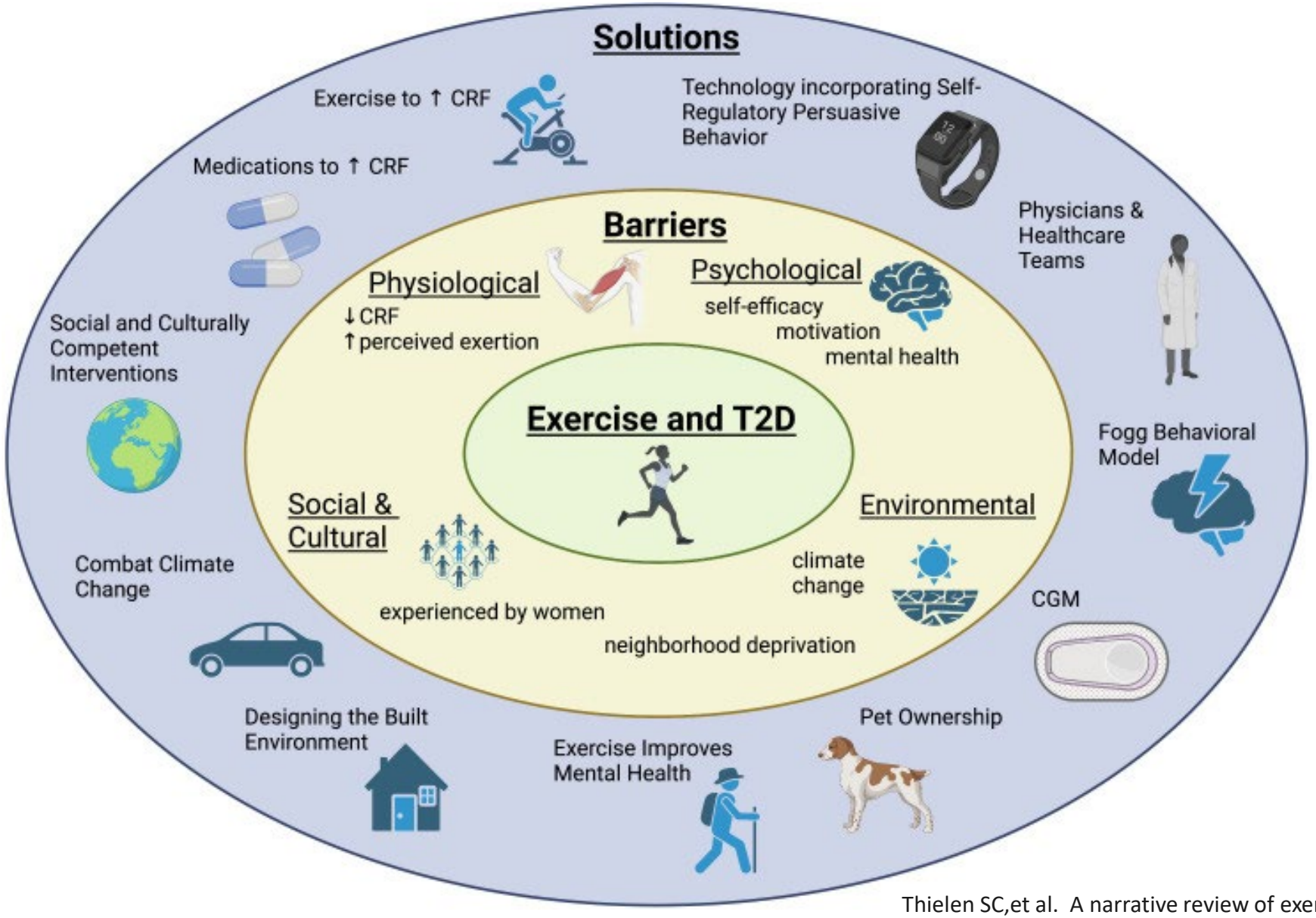


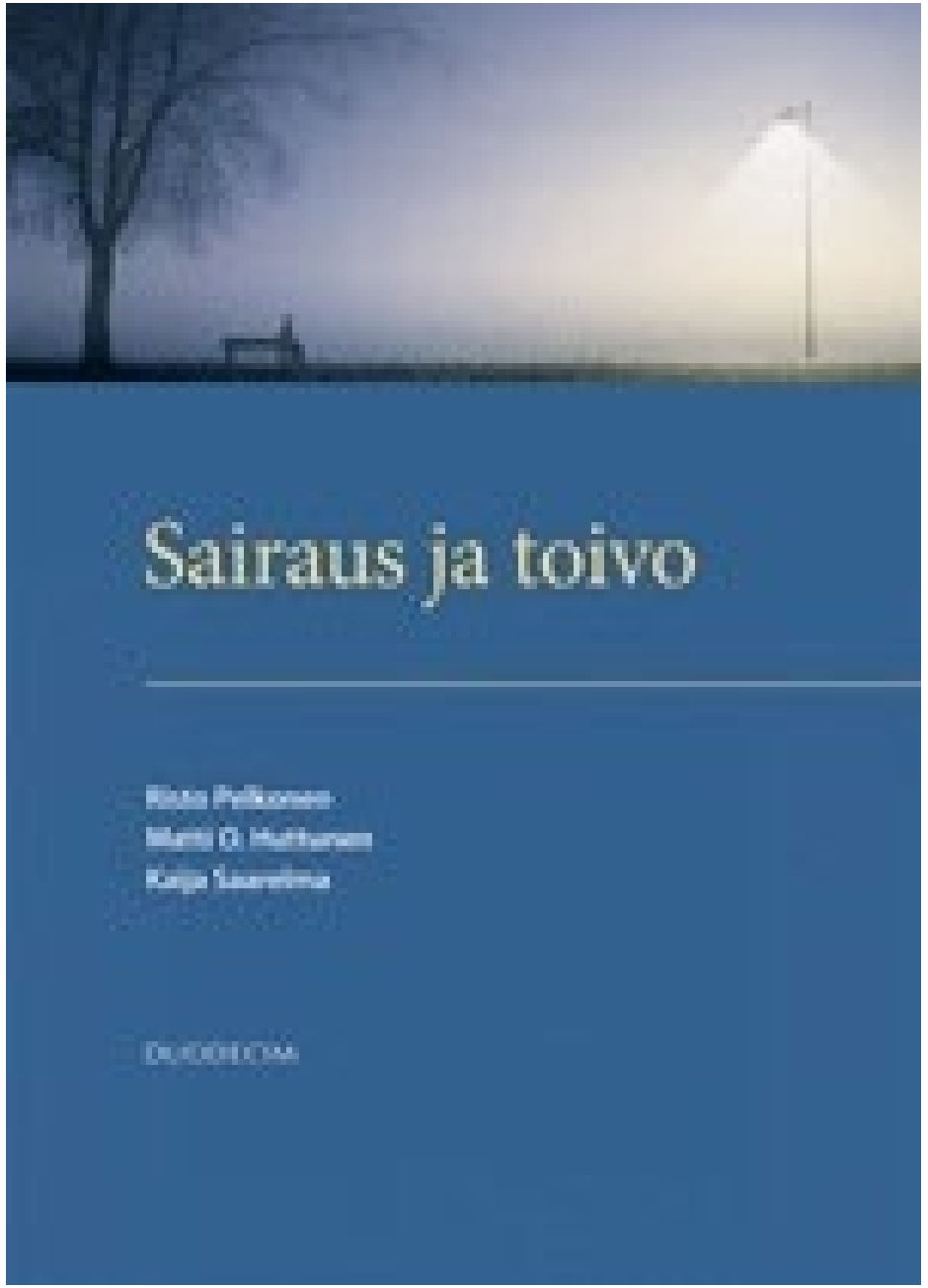

**Fig. 3** Graphic overview of results. BF: Body Fat, BMI: Body Mass Index, BW: Body Weight, DBP: Diastolic Blood Pressure, FBG: Fasting Blood Glucose, FFM: Fat-Free Mass, FI: Fasting Insulin, HbA1c: Glycated Hemoglobin, HC: Hip Circumference, HDL-C: High-Density Lipoprotein Cholesterol, HIIT: High-Intensity Interval Training, HOMA-IR: Homeostatic Model Assessment for Insulin Resistance, HRmax: Maximum Heart Rate, LDL-C: Low-Density Lipoprotein Cholesterol, MICT: Moderate-Intensity Continuous Training, RHR: Resting Heart Rate, SBP: Systolic Blood Pressure, TC: Total Cholesterol, TG: Triglycerides, $VO_2$max: Maximum Oxygen Consumption, WC: Waist Circumference, WHR: Waist-to-Hip Ratio

# Liikunnan esteitä pre – ja T2-diabeteksessa




Thielen SC,et al. A narrative review of exercise participation among adults with pr
type 2 diabetes: barriers and solutions. Front Clin Diabetes Healthc. 2023 Aug 30;4
doi: 10.3389/fcdhc.2023.1218692. PMID: 37711232; PMCID: PMC10499496.

# Onko toivoa ?

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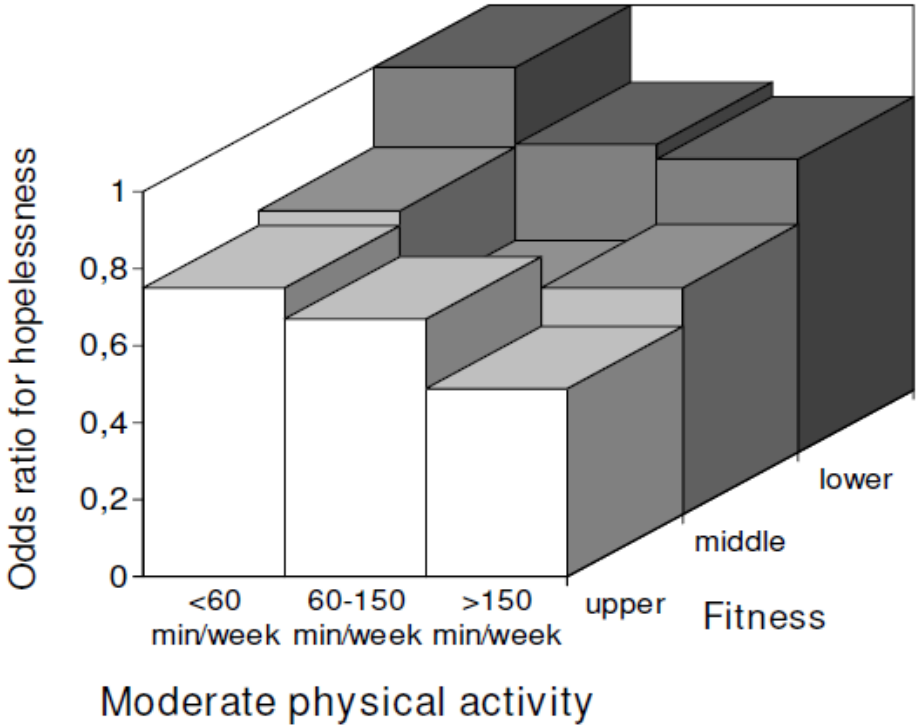
**Leisure-time physical activity, cardiorespiratory fitness and feelings of hopelessness in men**

Maarit Valtonen*[1,2], David E Laaksonen[2,3], Jari Laukkanen[4], Tommi Tolmunen[5], Rainer Rauramaa[6], Heimo Viinamäki[5], Jussi Kauhanen[4], Timo Lakka[3,6] and Leo Niskanen[2]

*BMC Public Health* 2009, **9**:204

**Hopelessness:** This is defined as the negative expectation that highly desired outcomes will not occur (or highly aversive outcomes will occur) and the belief that one is helpless to change this situation.



# Liikunta ja lihavuuden liitännäissairaudet

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- Liikunta tehokas viskeraalirasvakudoksen vähentämisessä
- Ruokavalioon yhdistäminen painonhallinnan kannalta merkityksellistä
- Prediabeteksessa metabolinen vaikutus huikea – edenneessä tyypin 2  diabeteksessa vaatimattomampi
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**Kiitoksia**