



Magnesium:

Is een hogere waarde beschermend voor mensen met verminderde
nierfunctie?

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Wetenschapsdag NVN, 14 oktober 2023



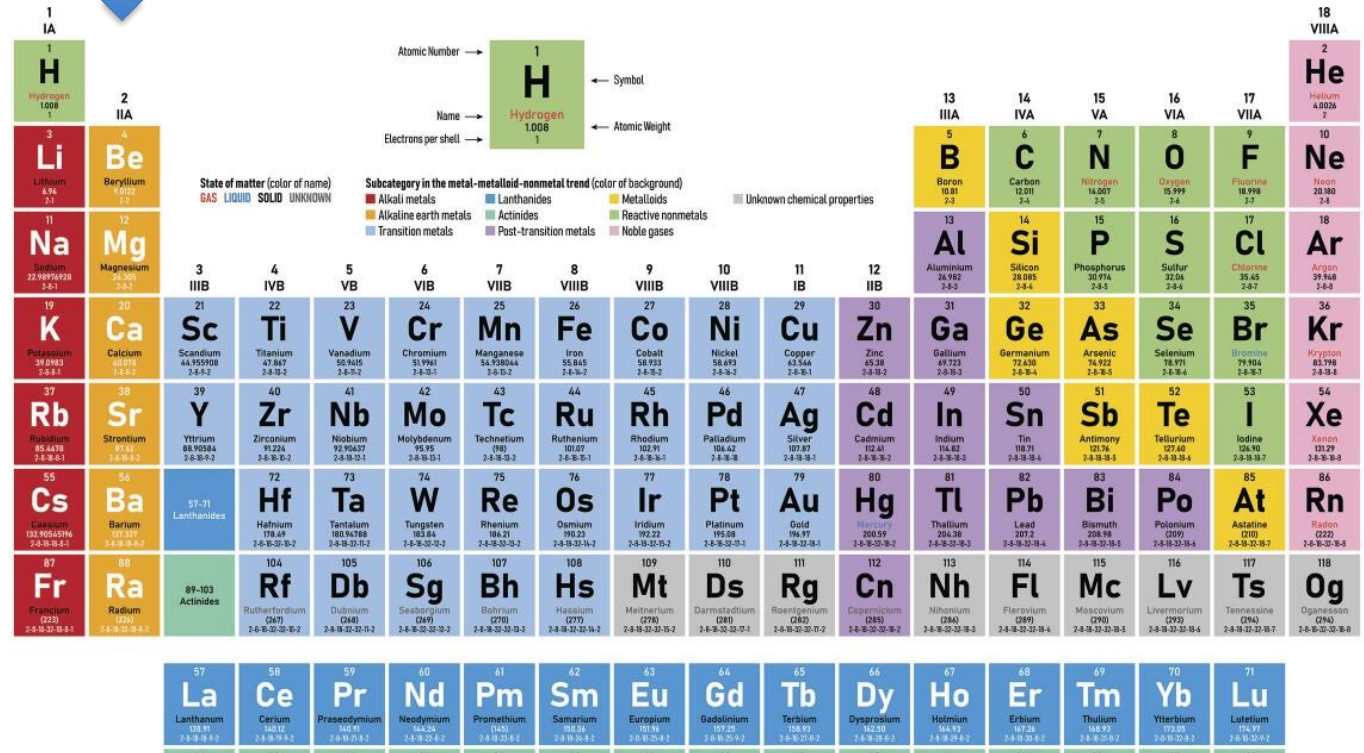
Disclosure

Onderzoeksgeld

- Nierstichting Nederland
- Health Holland
- Amsterdam UMC
- Fresenius
- Amgen
- Vifor
- NedMag (mijnbouw)

Fees (Betaald aan Amsterdam UMC)

- Amgen
- Otsuka
- Astra Zeneca
- Bayer





Het is een lichtgewicht metaal





Welk percentage van de massa van de aarde komt op het conto van magnesium?

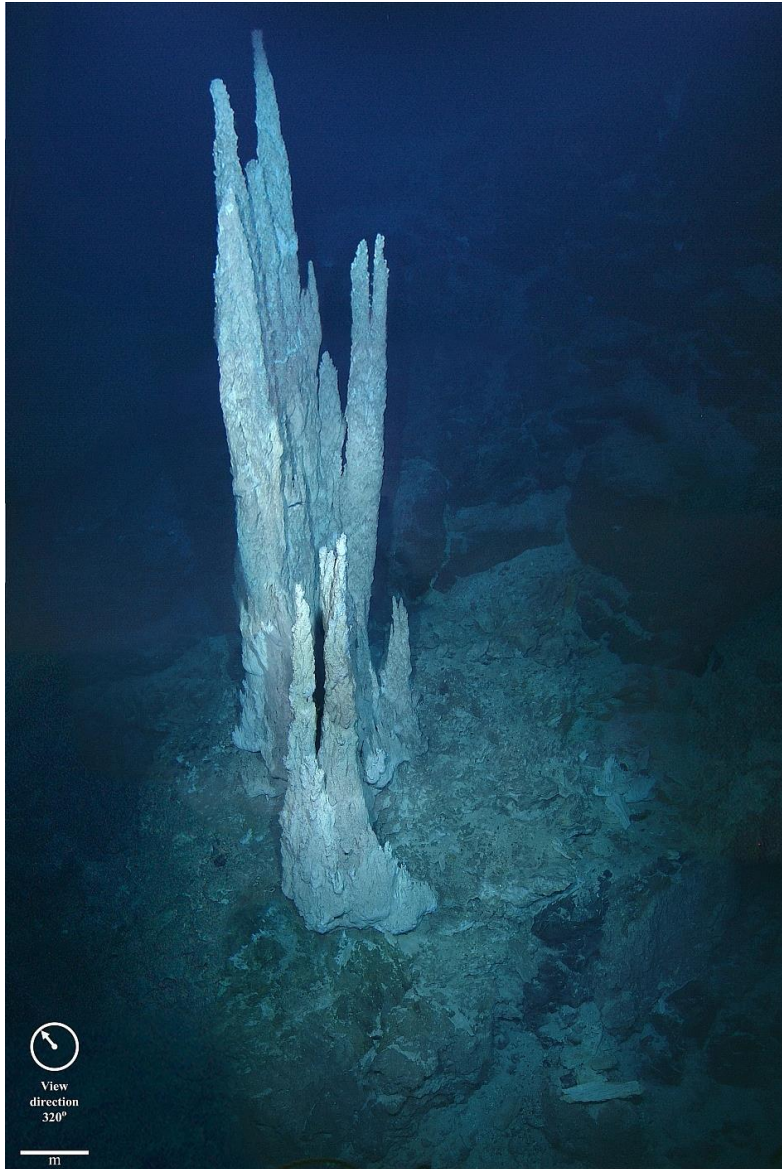
1. 0,00005%
2. 0,01%
3. 1,32%
4. 13%



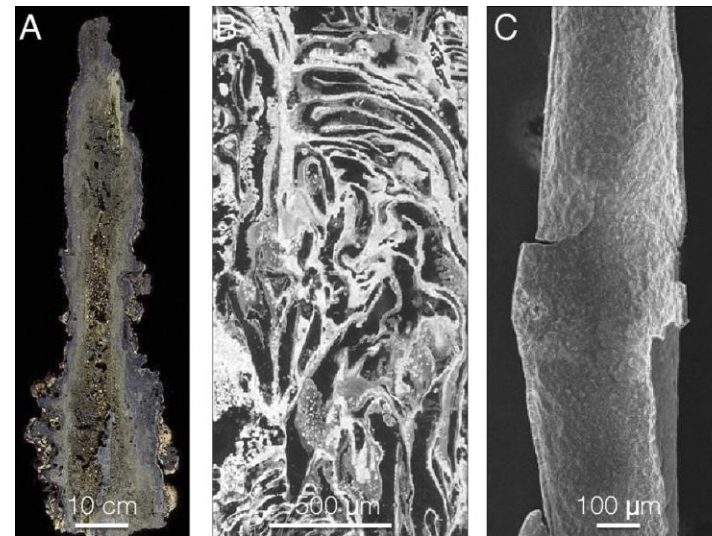


Waar komt magnesium vandaan?

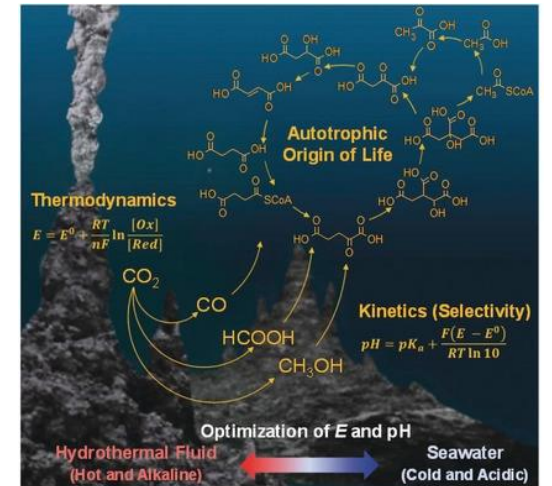




Magnesium in biologie



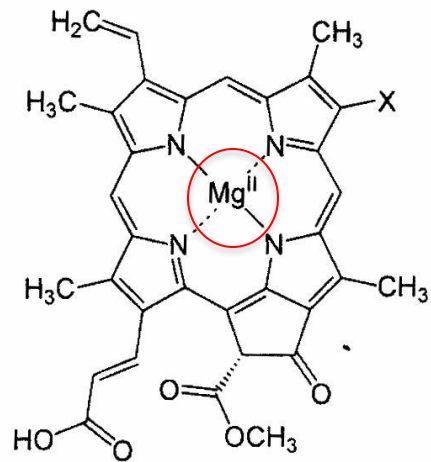
Ding, PNAS 2016



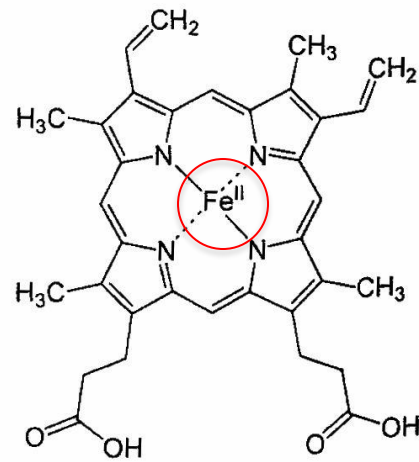
Ooka:
<https://doi.org/10.1002/celc.201801432>



55 mmol/l



Plant - Chlorofyl

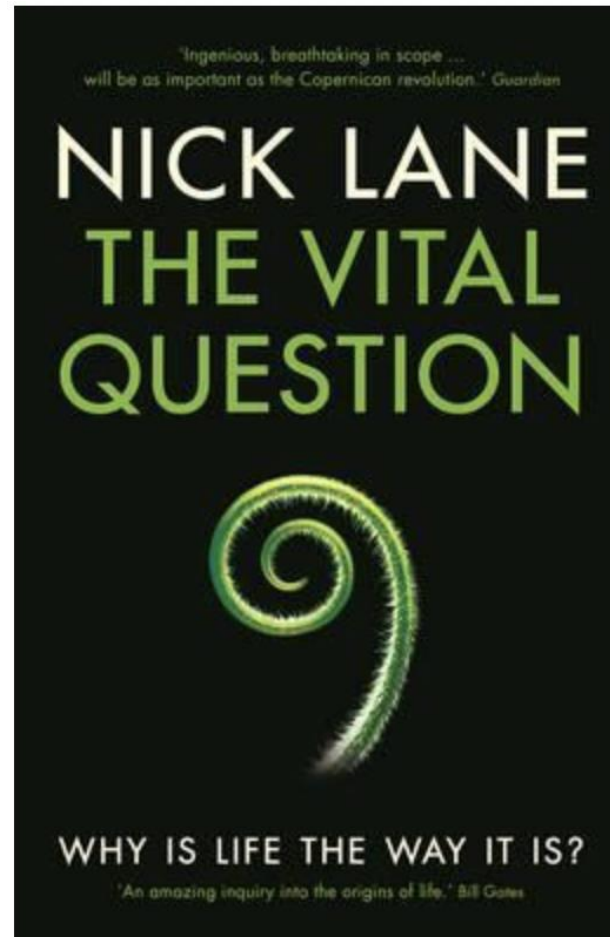


Mens - Hemoglobine





Meer weten?



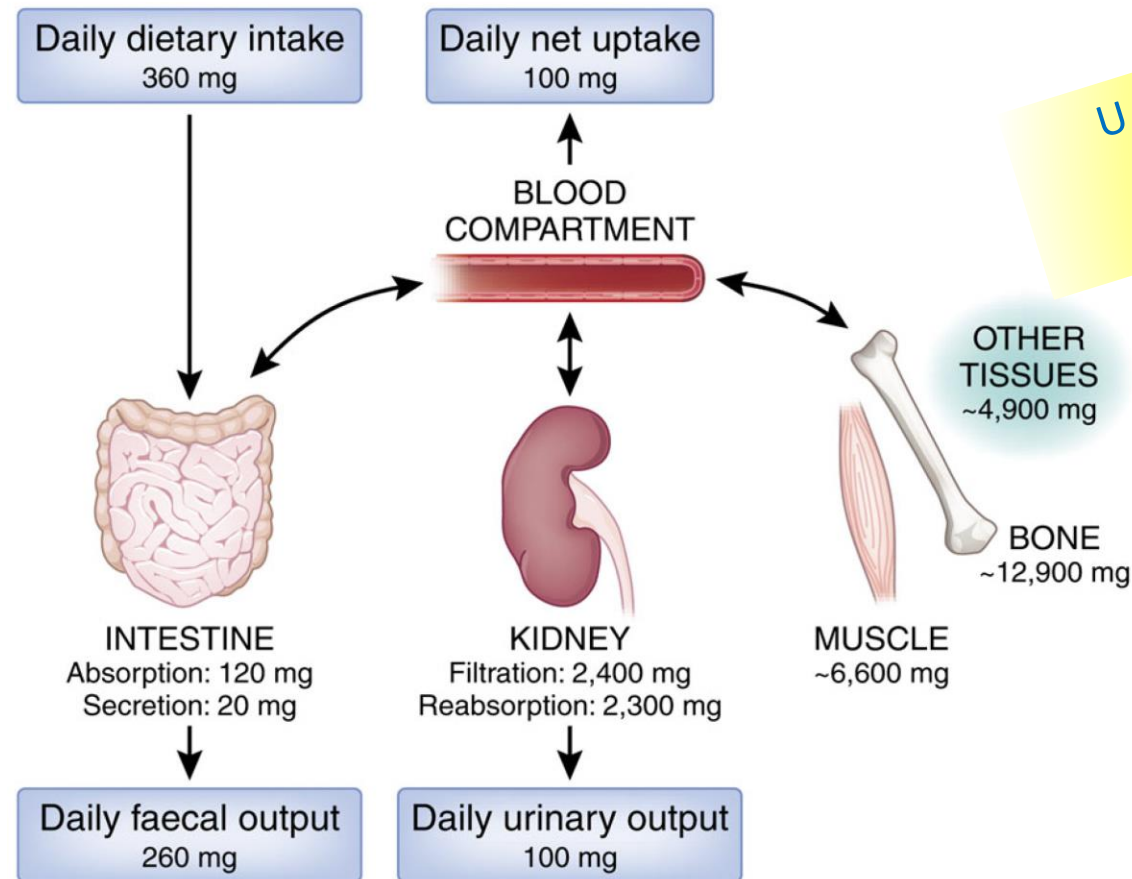


De fysiologie van magnesium



Magnesium huishouding in het lichaam

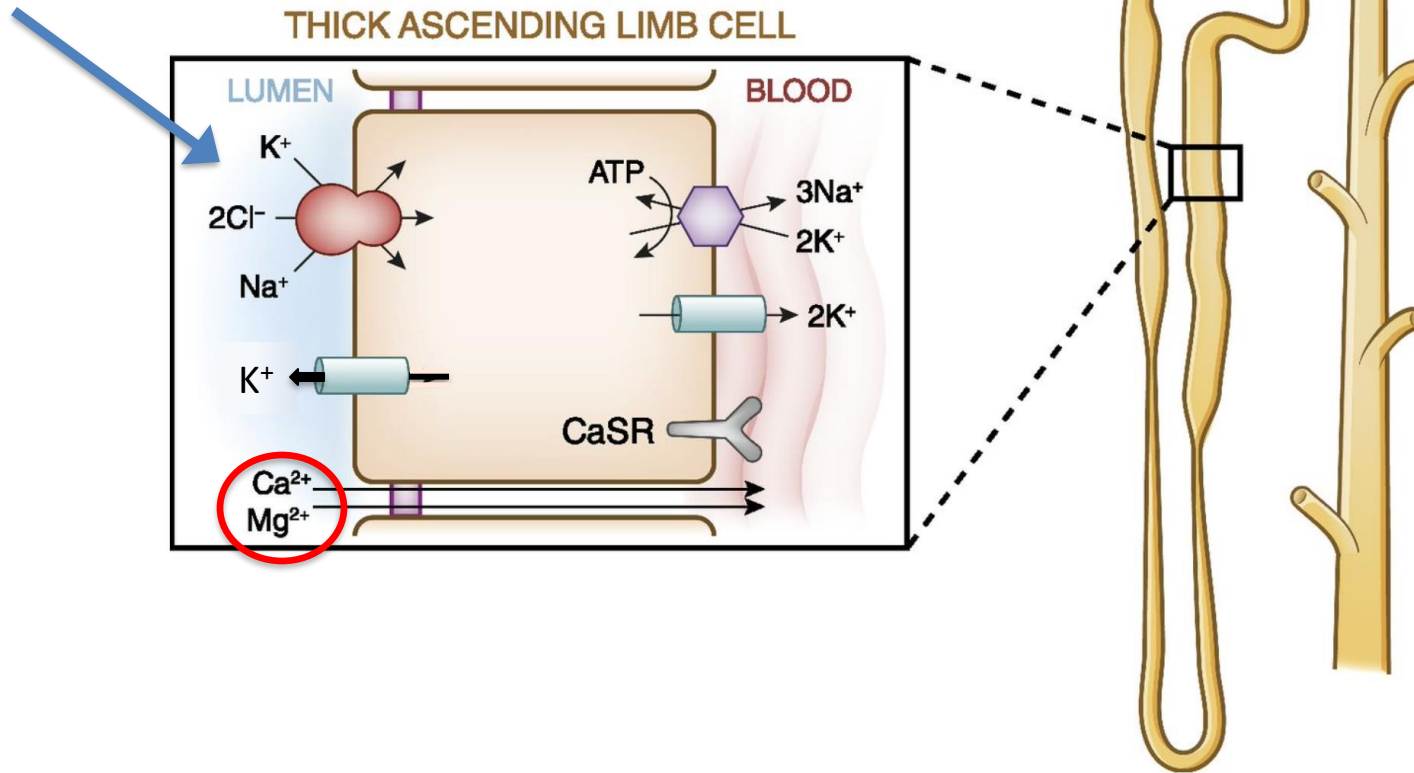
Regulation of magnesium balance



U bestaat zelf dus uit ongeveer 24 gram magnesium

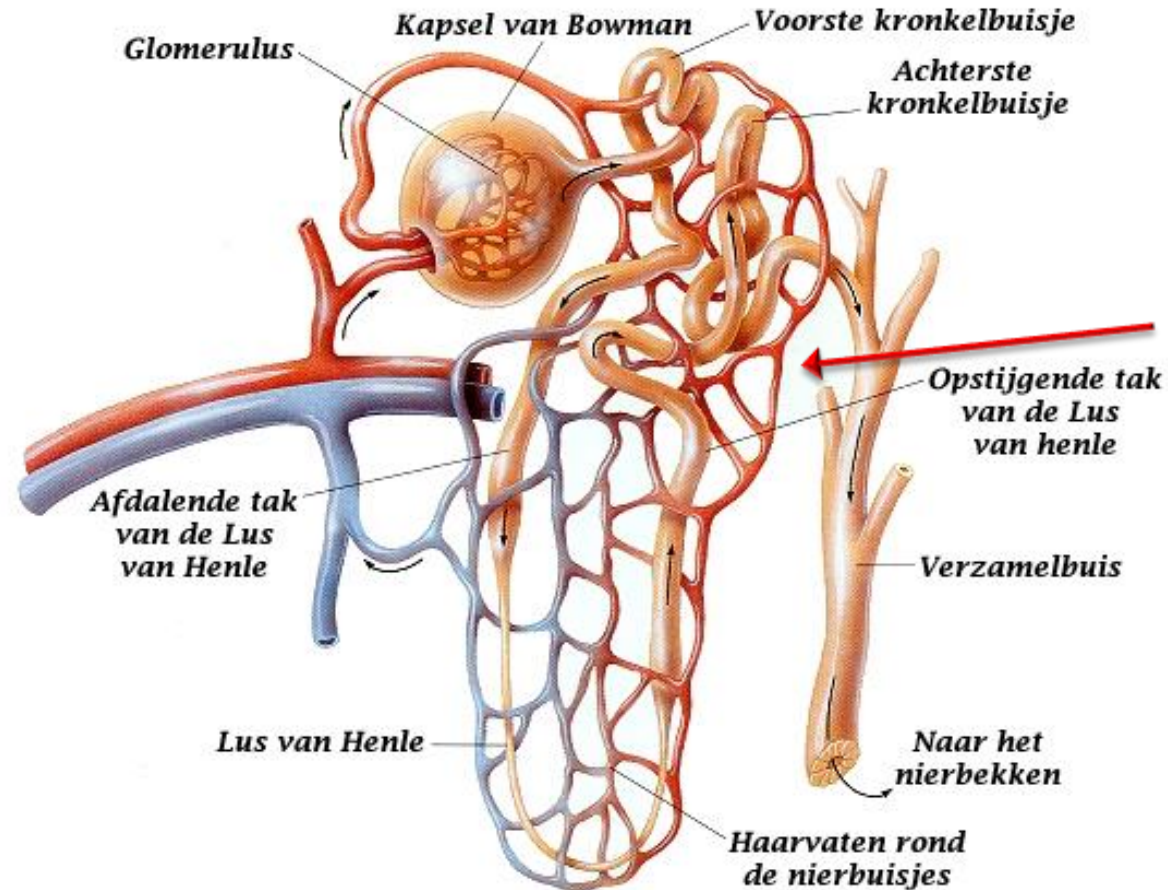


Furosemide
Bumetanide





De terugresorptie van Mg door de nier is uniek

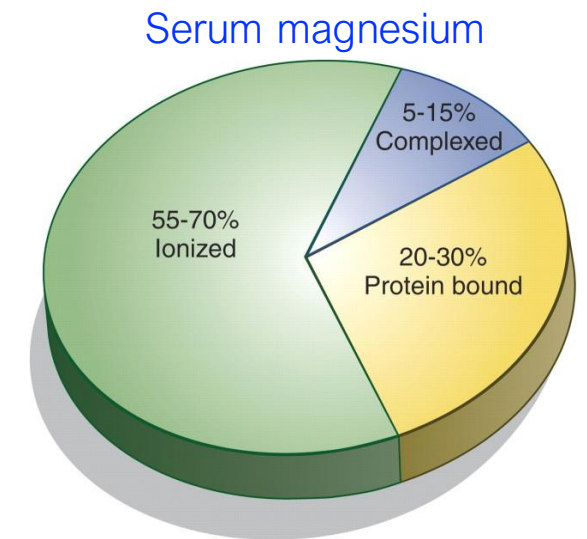


AMAZING!



Bepalen van magnesium status

- 1% van totaal magnesium bevindt zich in het serum
- Daar meten we doorgaans totaal magnesium
- Mogelijk dat magnesium in erythrocyten meer representatief is (kan “relatief” makkelijk)*

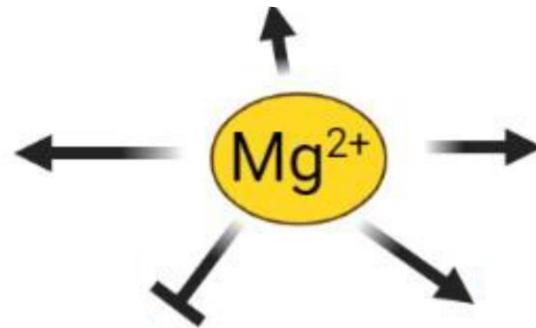




Bij verminderde nierfunctie is het lastiger om magnesium
“kwijt” te raken: Een voordeeltje?

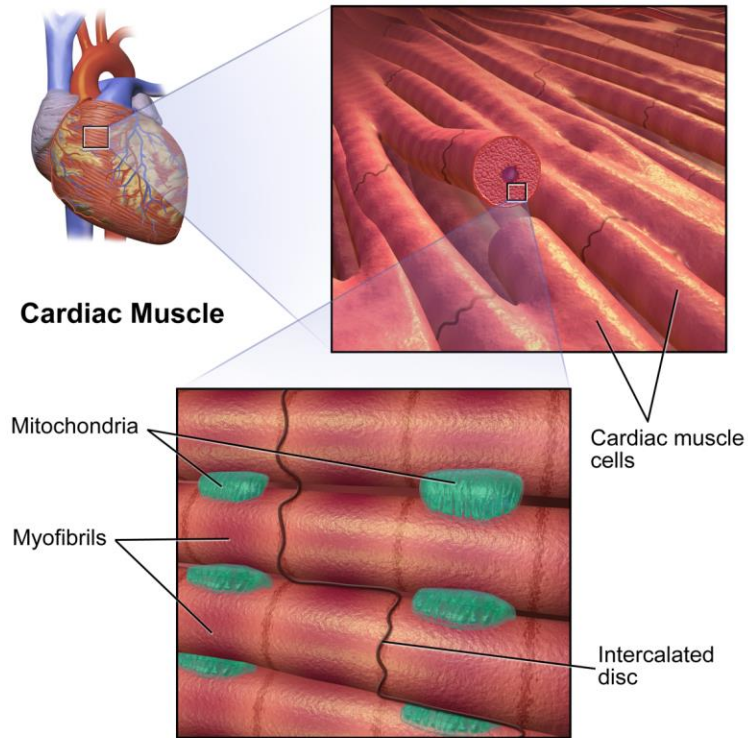


Is magnesium belangrijk?

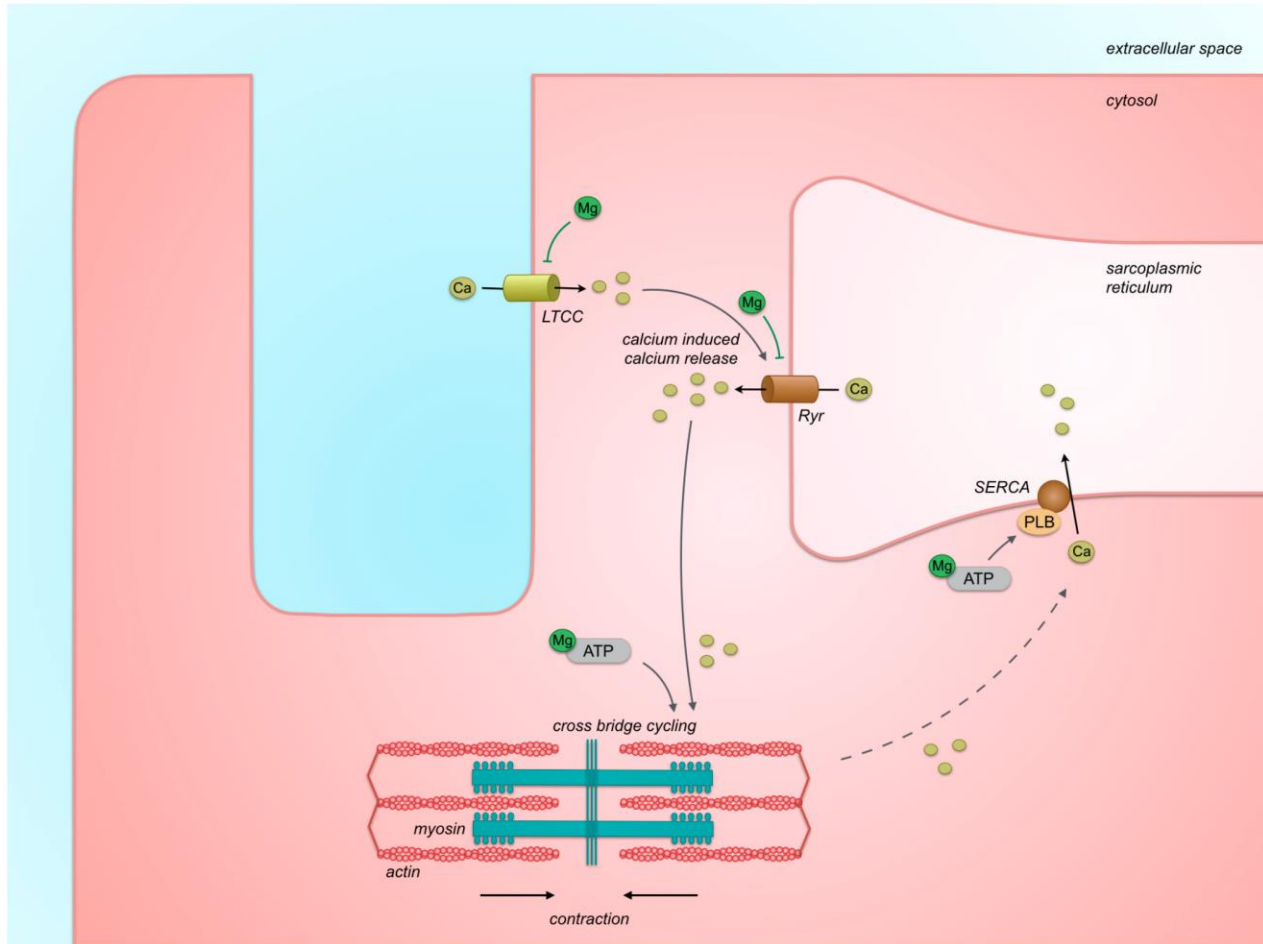




Magnesium is belangrijk voor hartspier



By Bruce Blaus

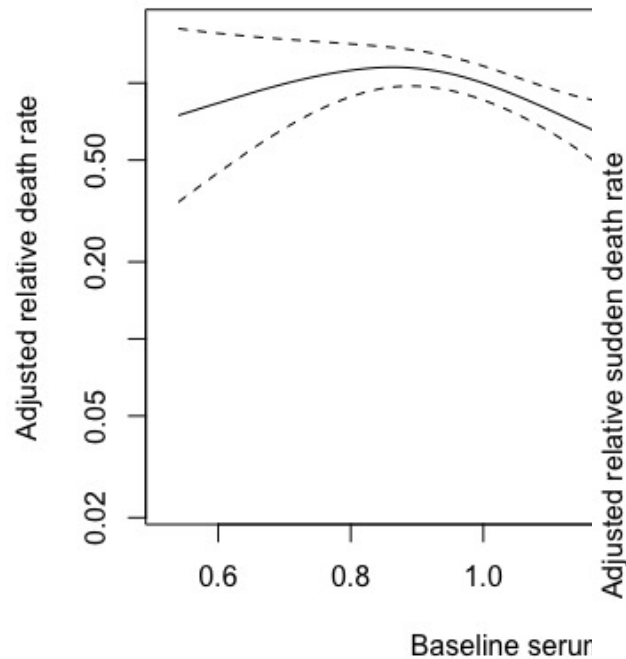




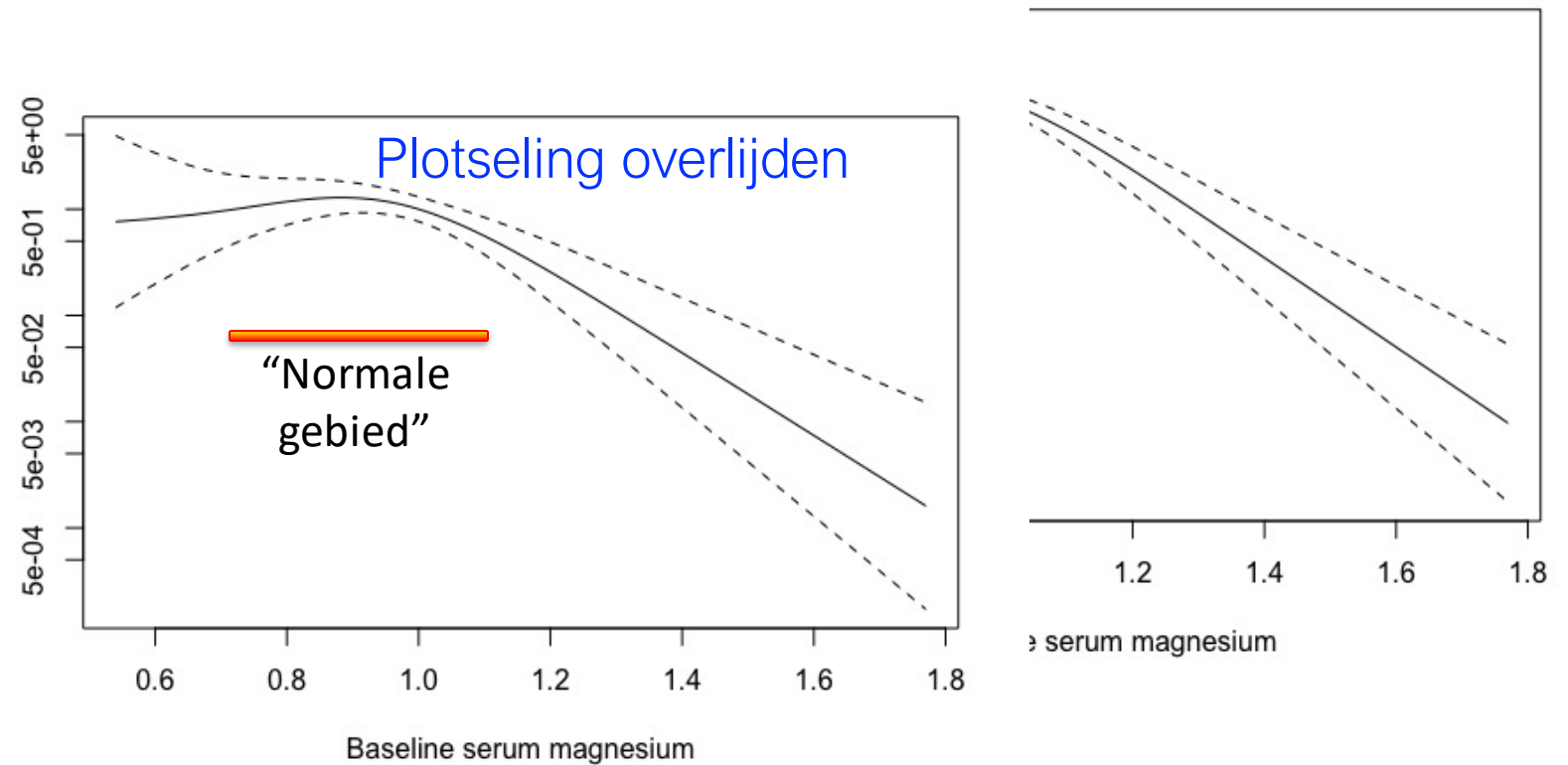
Magnesium en sterftekans

Dialyse cohort

Kans op overlijden

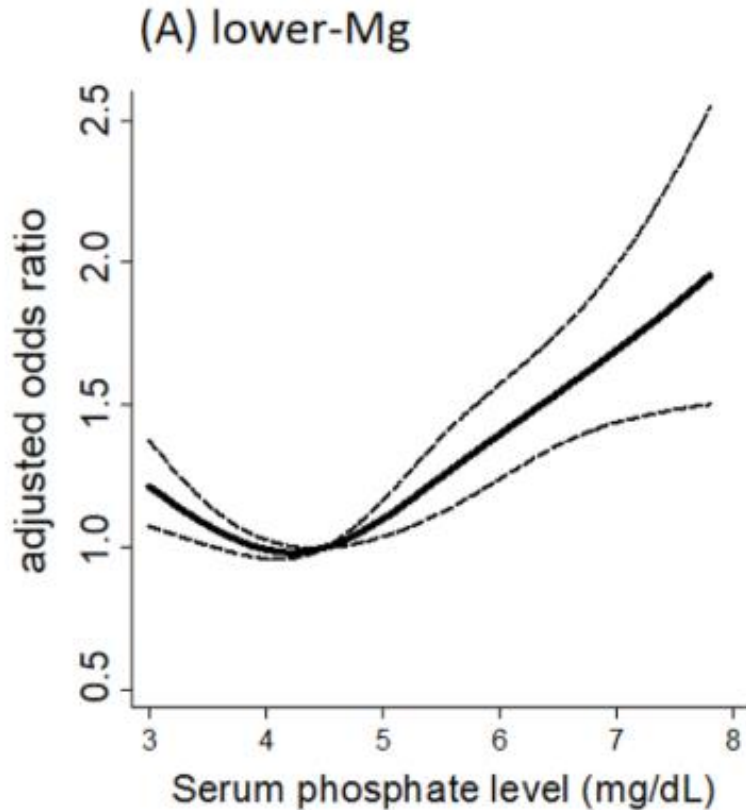


Overlijden door hart-bloedvat ziekte





Magnesium verlaagt het fosfaat-risico



Onderzoek bij [142.069 mensen](#) die dialyseren



Magnesium kan ook té hoog zijn

Japan, hemodialysis, n=142 555

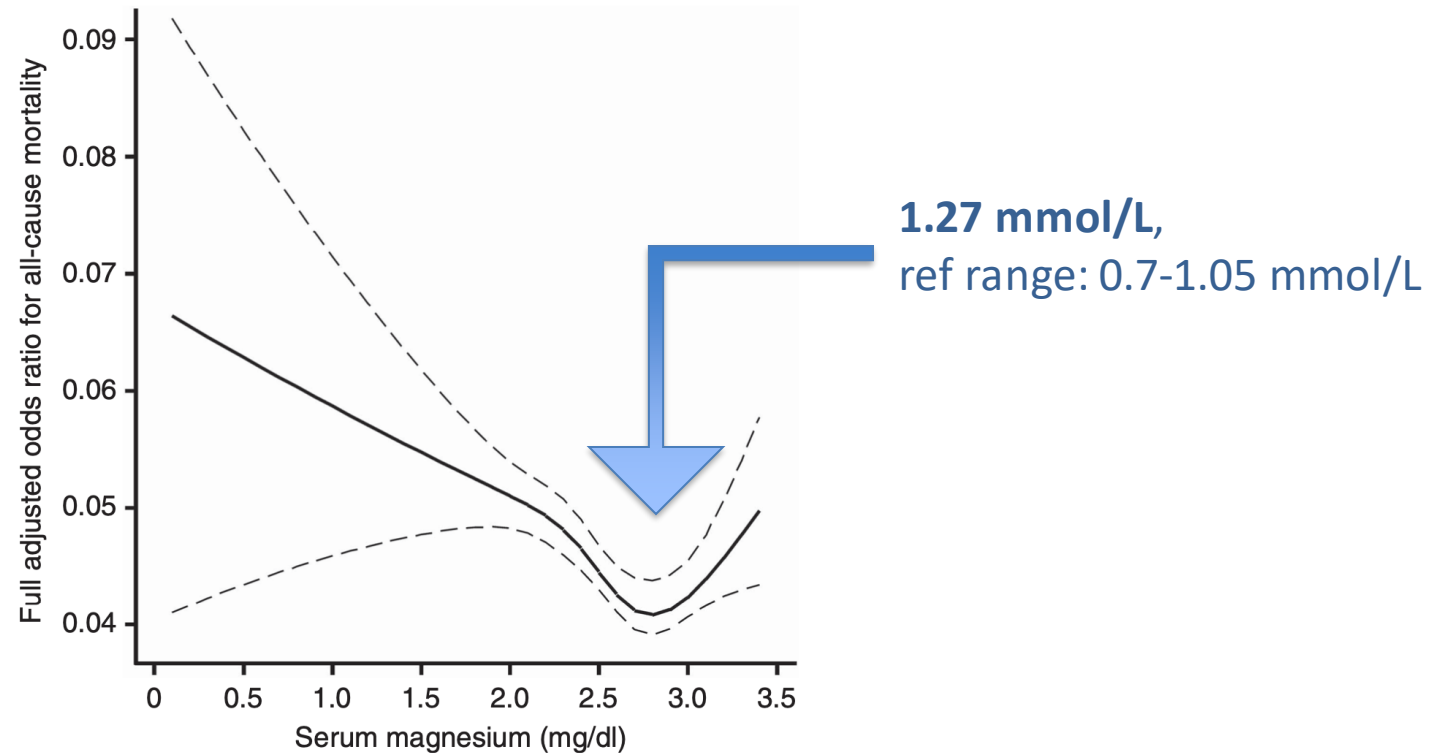
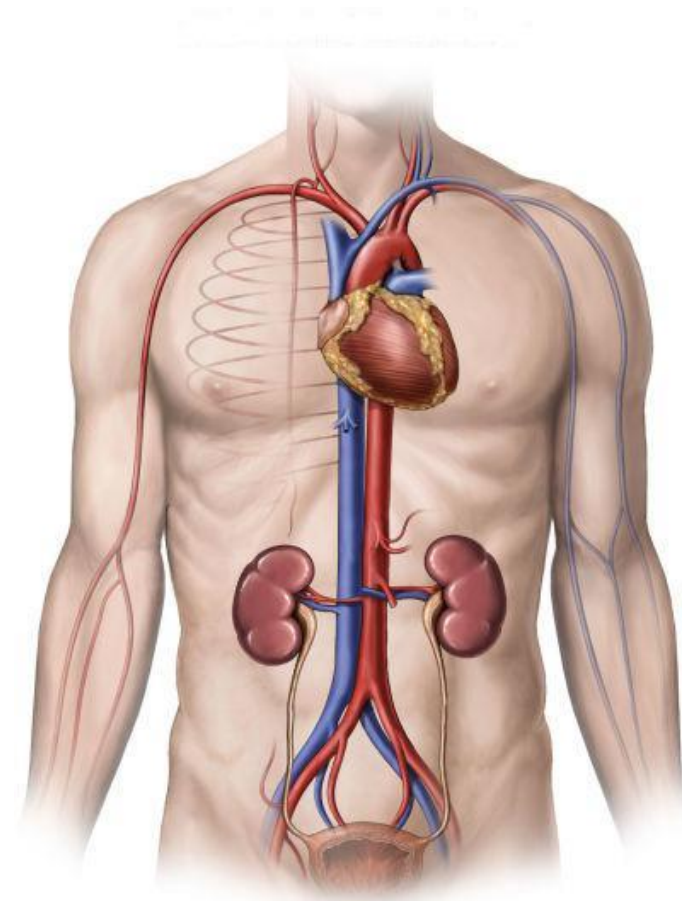


Figure 3 | Restricted cubic spline showing the fully adjusted associations between the serum magnesium level and all-cause mortality. The dashed line represents the 95% confidence interval.



Aorta: de lichaamsslagader

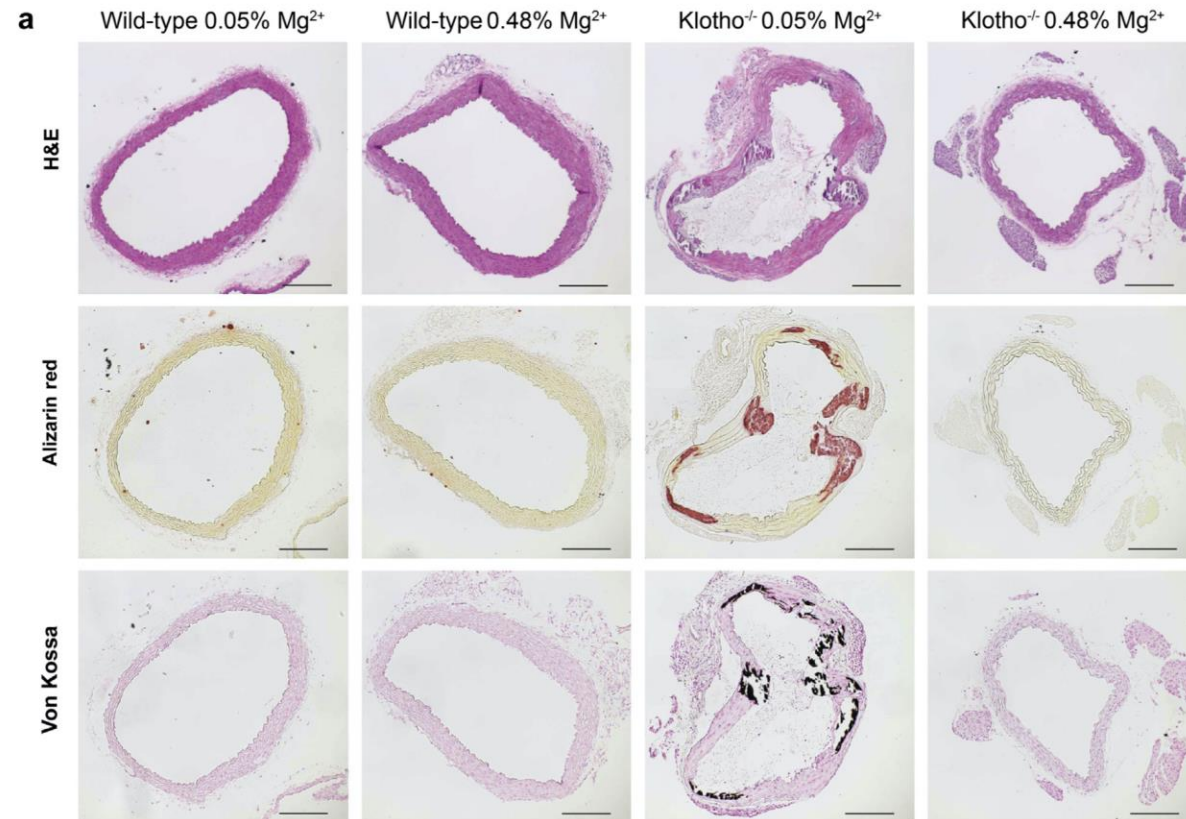




Magnesium-rijk dieet en vaatverkalking

AD ter Braake et al.: Magnesium prevents vascular calcification

basic research





Nier

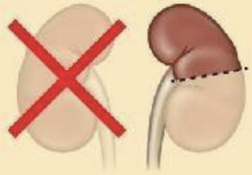


model van nierschade en aderverkalking

Methods



46 Sprague Dawley rats



Partial nephrectomy



Diets during 16 weeks:
P1.2% and
Mg 0.05% OR Mg 0.48%



Blood and 24 h urine

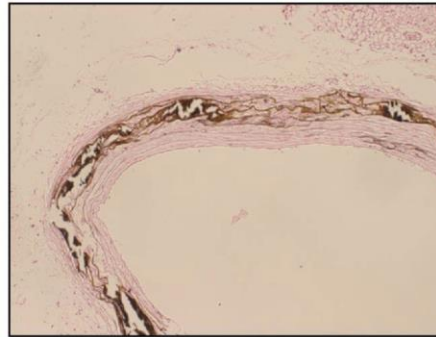
- Minerals



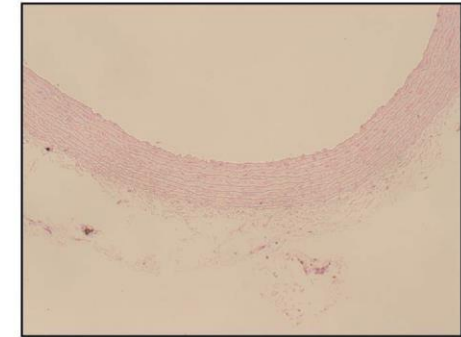
Aorta

- Calcium content
- Von Kossa staining
- Gene expression

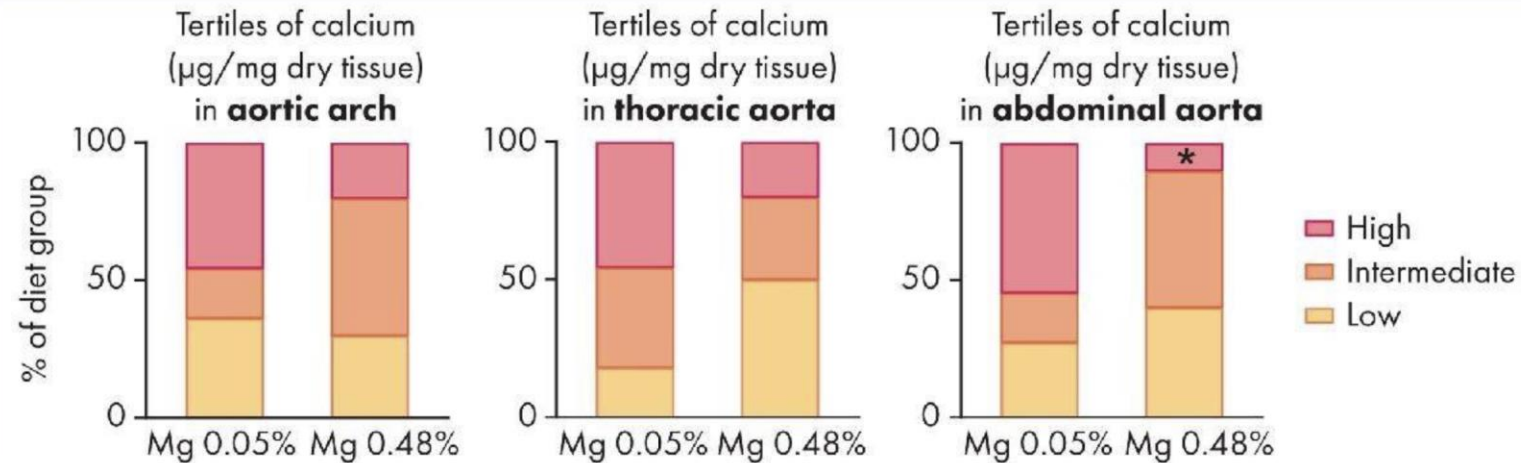
Von Kossa staining of the aorta



Mg 0.05% group,



Mg 0.48% group,

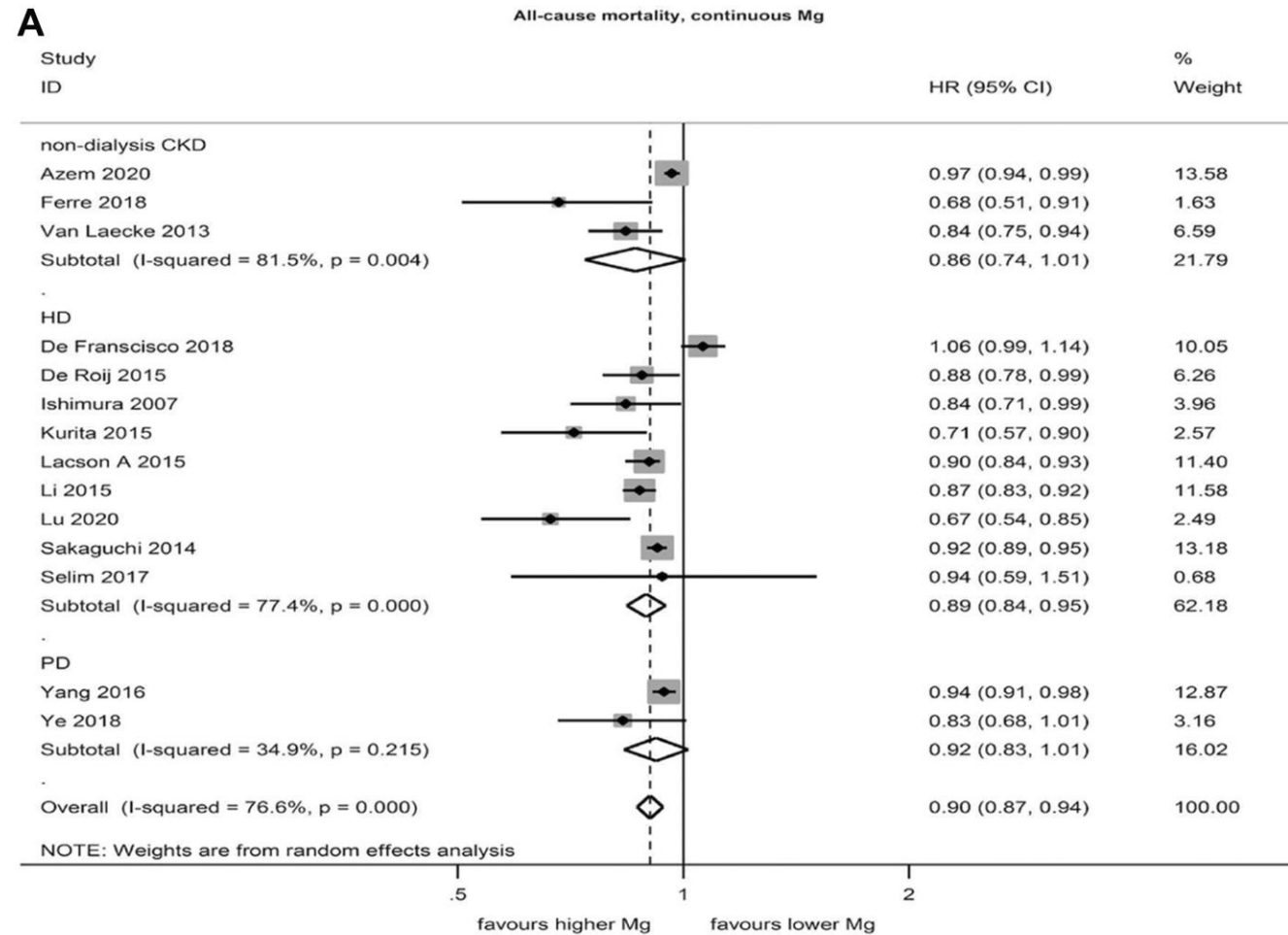




Onderzoek bij mensen



Meta-analyse associatie Mg-sterfte bij CNS





Oorzaken

- Ongezonde voeding
- Proton pomp remmers (middelen tegen maagzuur)
- Alcohol-misbruik
- Ernstig “darm”- falen
- Cisplatina, calcineurine remmers, aminoglycosides
- Specifieke zeldzame tubulaire stoornissen



Wat zouden we kunnen doen?





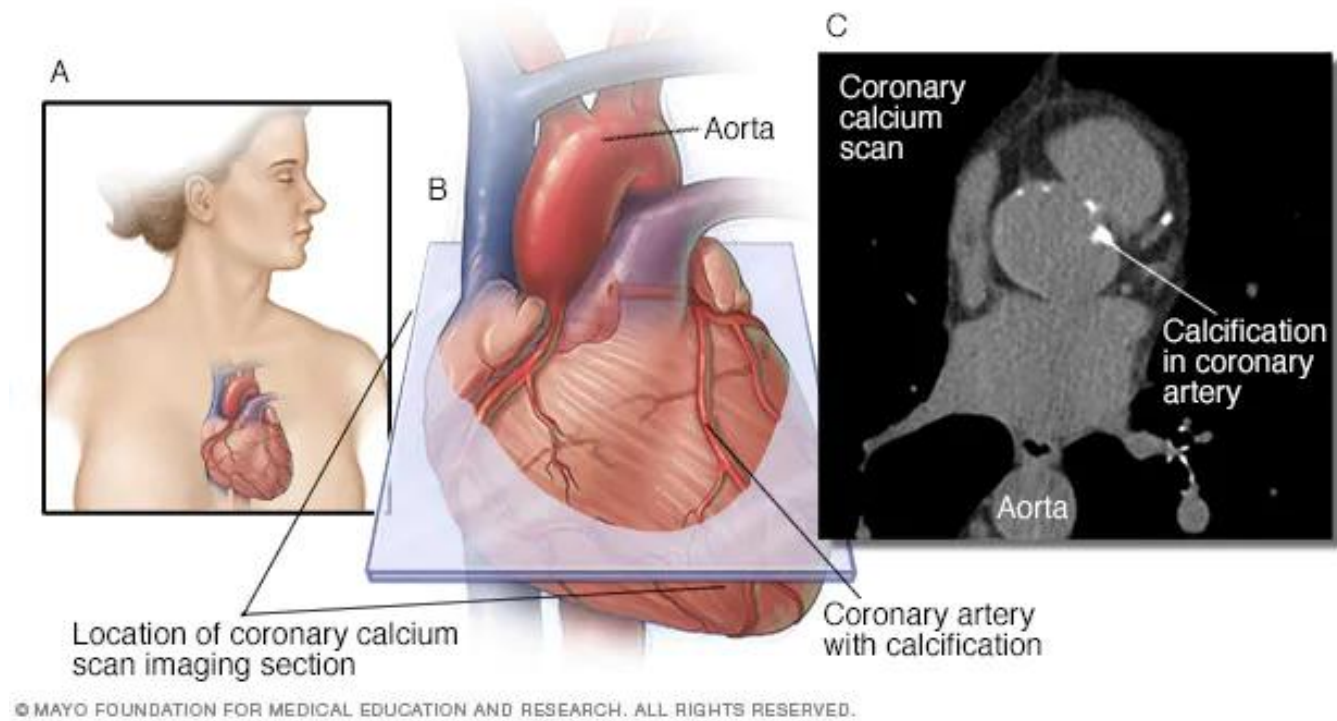
Orale magnesium supplementen?

Formulation	Form	Elemental Mg, milligram/day	Elemental Mg, millimol/day	Studies
Mg carbonate				
Mg oxide				
Mg citrate	Capsules, pastilles	50 mg ^c –350 mg	3–15 mmol	[30,31]
Mg hydroxide	Slow release tablets	360–720 ^d mg	15–30 mmol	[32]

- Worden niet zo makkelijk opgenomen door de darmen
- Kunnen wel bijwerkingen hebben (misselijk, diarree)



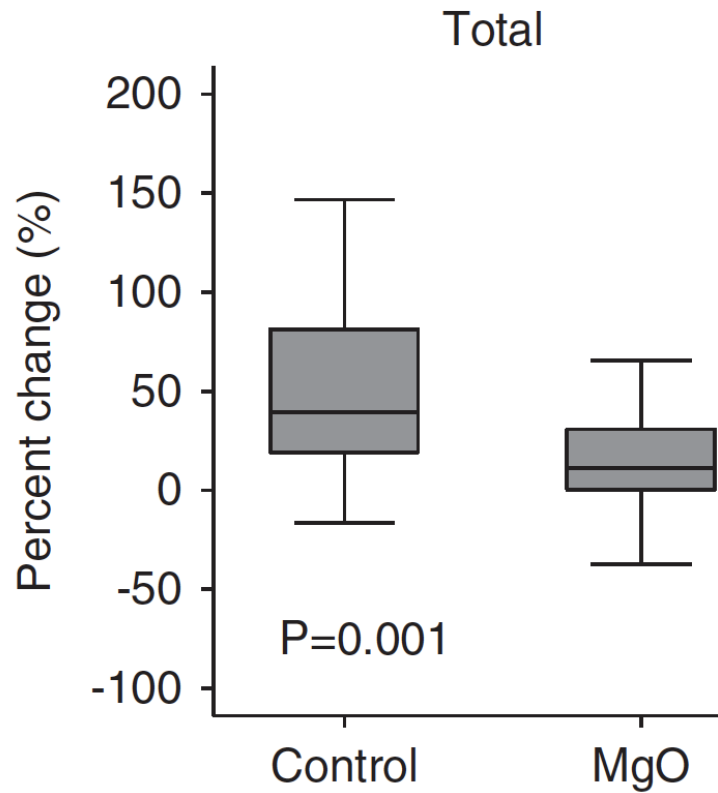
Klinische studie: Extra magnesium bij CNS



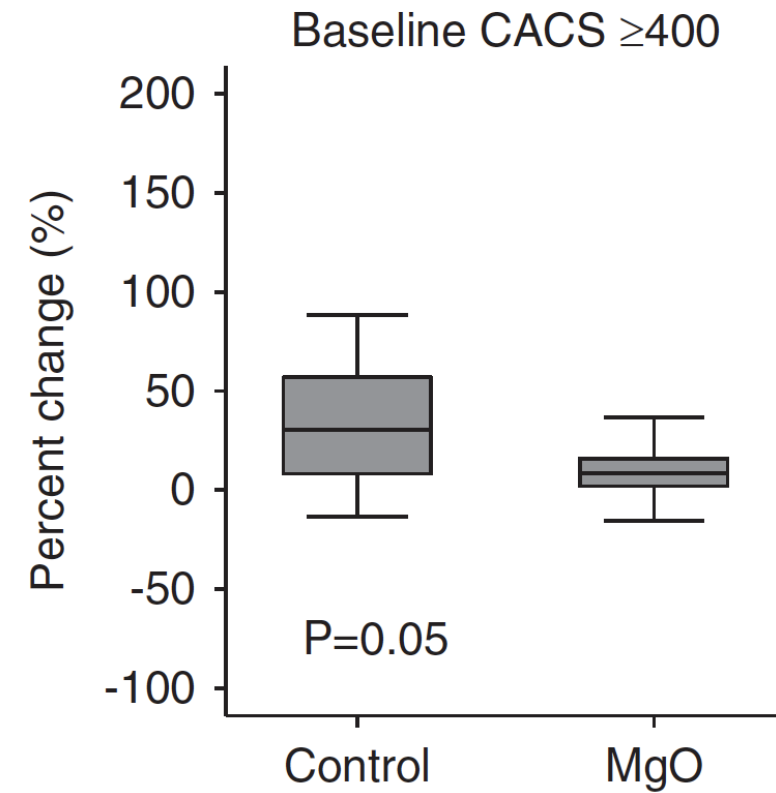
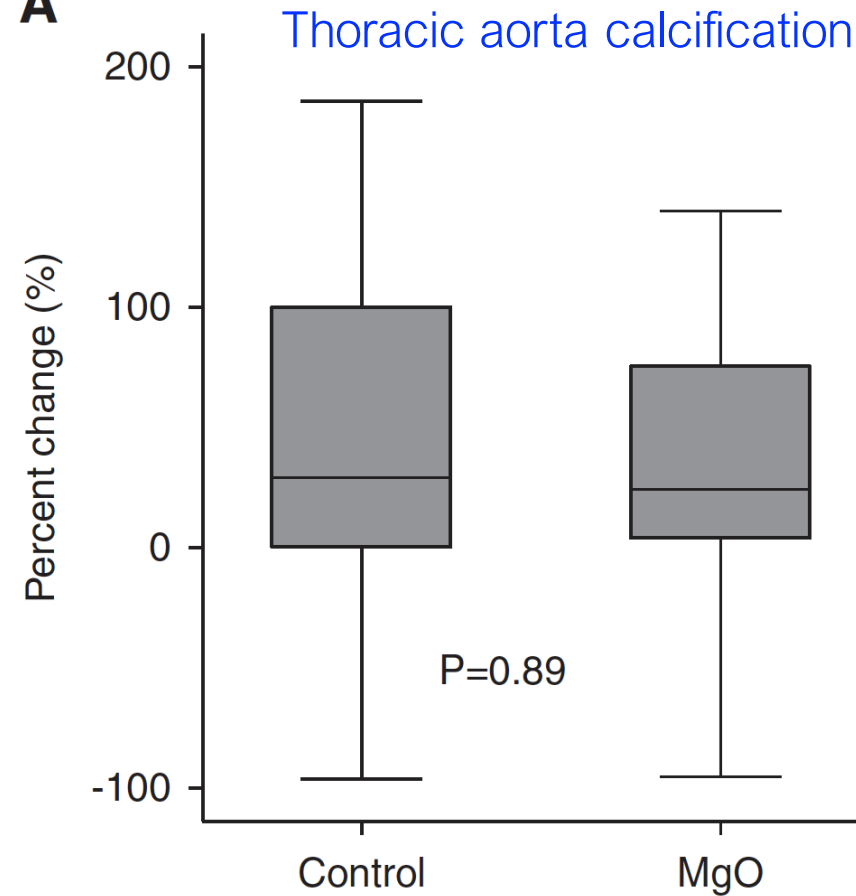


Klinische studie: Extra magnesium bij CNS

A



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Maar toen kwam deze studie.....

The Effect of Magnesium Supplementation on Vascular Calcification in Chronic Kidney Disease (MAGiCAL-CKD) – A Randomized Clinical Trial

JASN
JOURNAL OF THE AMERICAN SOCIETY OF NEPHROLOGY

Methods

Randomized, double-blind, placebo-controlled, parallel group, clinical trial



eGFR 15 – 45



Magnesium hydroxide
vs.
placebo

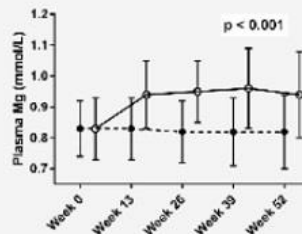
Randomization 1:1



52 weeks



Outcomes



CAC progression

Placebo	31.2% p < 0.001
Magnesium	33.3% p < 0.001

Difference in CAC between groups

0.9% p = 0.438

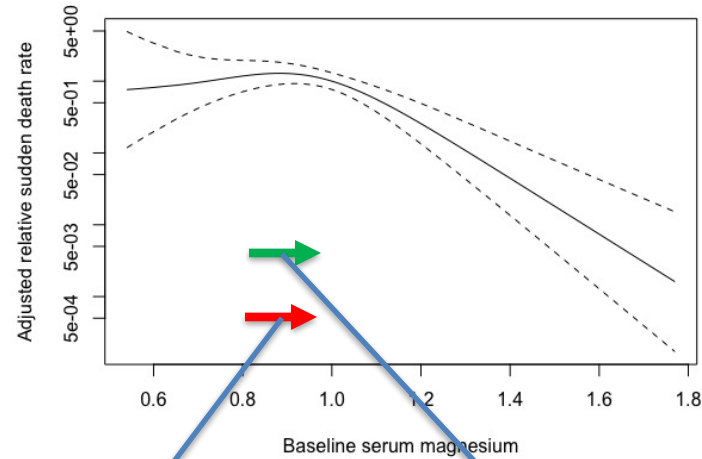
Conclusion

Magnesium supplementation did not slow the progression of CAC after one year, despite a significant increase in plasma magnesium.

DOI:10.1681/ASN.0000000000000092



Hoe kan dat???



Bressendorff:

- Double blind
- Fixed dose
- 1 year FU

Sakaguchi:

- Open label
- Titrated
- 2 year FU

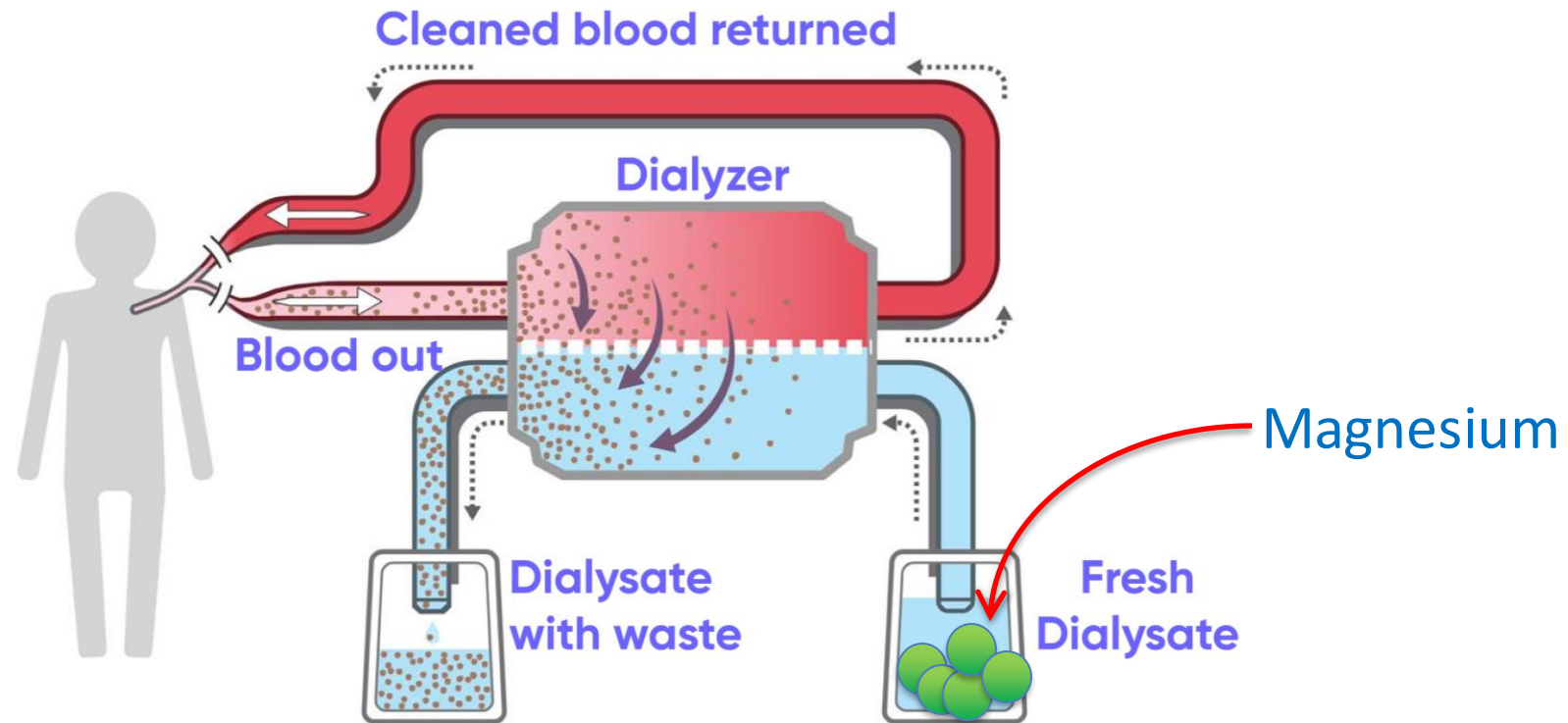


Magnesium gehalte in het dialysaat



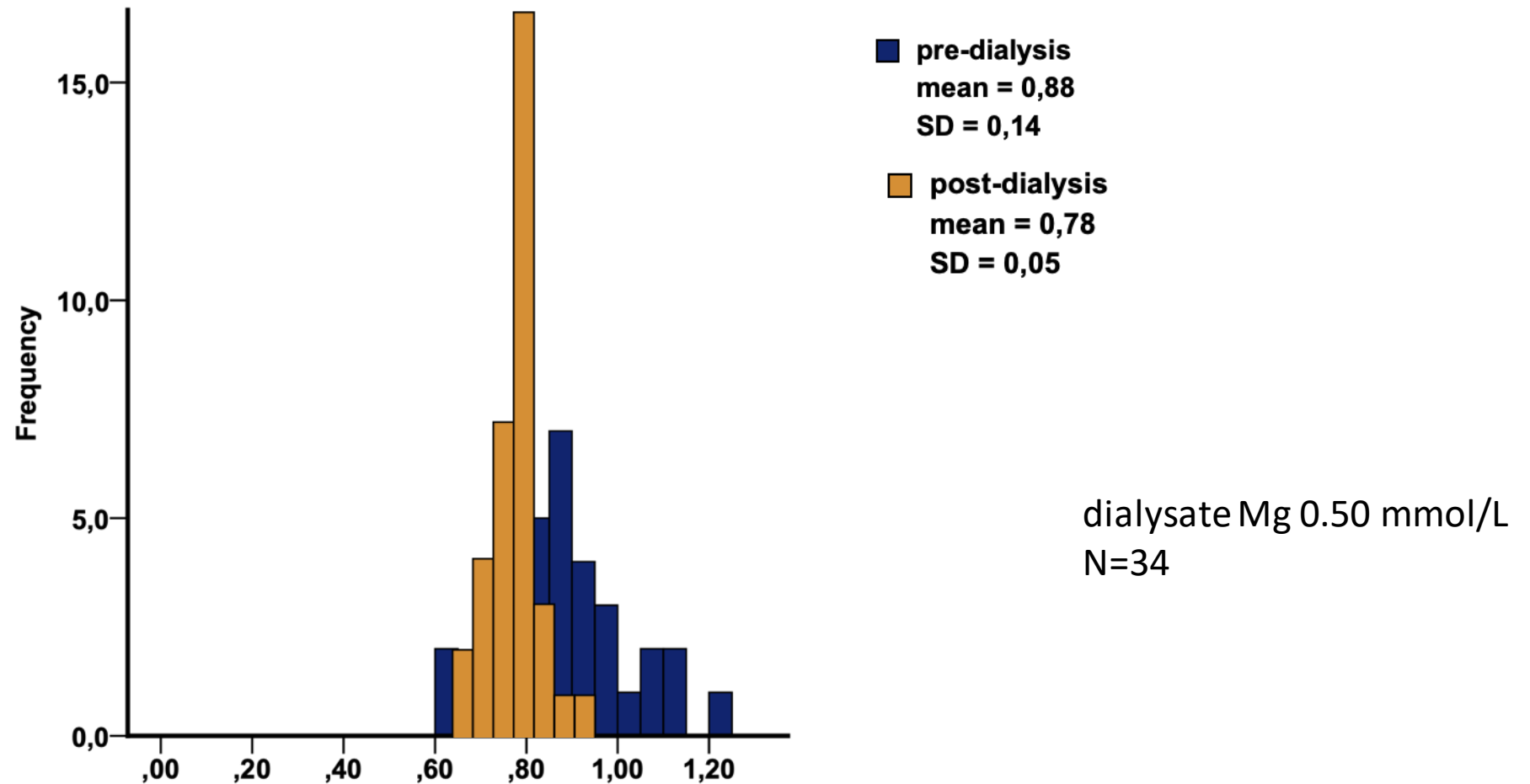


BLOCK DIAGRAM HAEMODIALYSIS





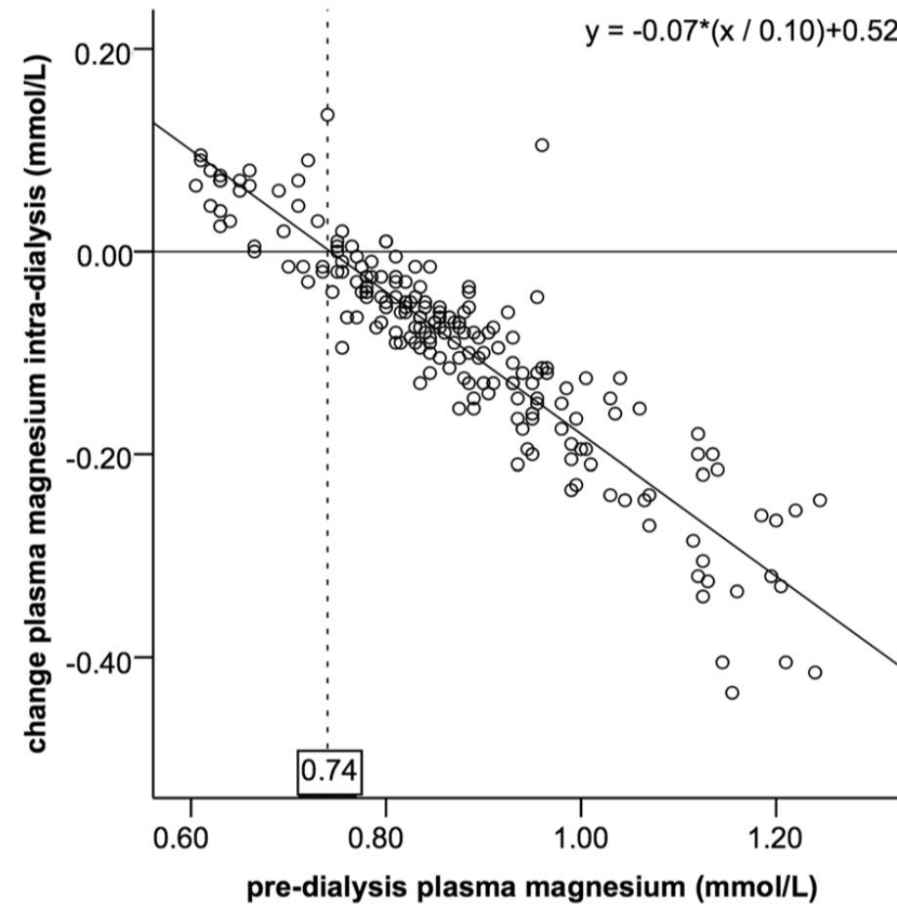
Magnesium beloop bij hemodialyse





Effect van hemodialyse op [Mg]

dialysaat 0,5 mmol/L





We just finished this one....

BMJ Open Magnesium in chronic haemodialysis (MAGIC-HD): a study protocol for a randomised controlled trial to determine feasibility and safety of using increased dialysate magnesium concentrations to increase plasma magnesium concentrations in people treated with haemodialysis

Nicoline H J Leenders ,^{1,2} Caroline E. Douma,³ Joost G.J. Hoenderop,²
Marc G. Vervloet¹



Conclusie

- Magnesium verdient wat meer aandacht
- We kunnen niet goed de “magnesium-status” vaststellen
- Hypomagnesiëmie: malabsorptie (PPI) of renaal verlies (diuretica)
- Magnesium: kan ernstige gevolgen hebben
- Orale suppletie is lastig (bio-beschikbaarheid, bijwerkingen)
- Gezonde voeding!



Radboudumc

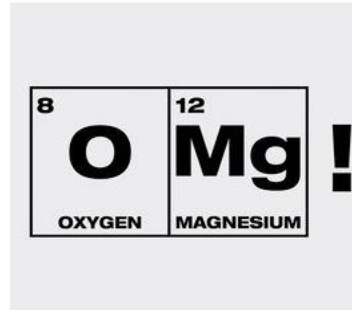


Jeroen de Baaij



Joost Hoenderop

Martin de Borst en Jan-Luuk Hillebrands



Thank you!

Emma
Vermeulen



Niki
Leenders

